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D. M. Campbell, Editor A. T. Kinsley, Associate Editor

The Reason for a Poultry Practice Issue

IT IS not an accident that every problem in which veterinarians as such are interested, is discussed in VETERINARY MEDICINE in the course of a year. It doesn't just happen that all general phases of veterinary practice in which considerable numbers of veterinarians are interested are discussed in each issue of VETERINARY MEDICINE. There is before the editors constantly a chart on which is platted, according to the best information they are able to obtain, the percentage of veterinarians interester in the various phases of veterinary medicine for each month in the year. Month by month, the number of pages devoted to each phase of the subject is marked on this chart. When such a plan is followed, no subject will be neglected for long, because it has been overlooked or forgotten. The chart is a constant reminder of what is due and what has been given. Of course, a certain amount of attention is given to matters that the editors believe from their contacts need to be promoted and to the requirements of general information on medical science, sanitation, public health, etc., irrespective of the present interest of the profession in such matters.

It seems appropriate to make the foregoing explanation in making a departure from well-established custom so radical as is made in this issue. Probably no reason that can be given will justify devoting an entire issue to a discussion of poultry practice in the minds of some who have no poultry practice, no chance to develop any poultry practice and no personal interest in the subject. To such we would say—be patient, the chart will remedy, in the course of a few months what, to you seems grave omission this month. As Byron said, "Time at last sets all things even." And further, the results of diseases of poultry affect not only the industry but indirectly, every one.

The losses to the live stock industry from infectious disease are of importance to every American citizen. Agriculture represents our greatest investment of capital. Successful agriculture depends largely upon a profitable live stock industry. The security of the live stock industry depends much upon protection from infectious diseases and parasitisms of farm animals. A great percentage of the food of our people, their clothes, medicinal preparations and a thousand and one necessities are obtained from live stock. If this source of food is diminished, want, misery, disease and death will increase among mankind; the fertility of the soil will be impaired. Poultry represents our first live stock industry in point of numbers and accounts for nearly a fifth of the total production of the industry. Its conservation is of importance to national pros-

perity and well being, and the veterinarian who has at heart the safeguarding of poultry from disease assumes an importance in the personnel of his community.

Admittedly there has been no great demand from readers for a poultry practice issue, and were such an issue to be merely a miscellaneous collection of articles on poultry subjects that, while excellent in themselves, bear no definite relation to one another, we should feel there was little justification for so grouping them, and none for designating such an issue a special number.

In this issue we have attempted to present authoritative discussions on most of the important subjects with which poultry practice is concerned, and the effort has gone very much further than that in the attempt to present this discussion as logically as in a textbook without the detail necessary to a treatise of that sort. In fact, several of the most important subjects here discussed are not included in any textbook on poultry diseases.

The aim in this Poultry Practice Issue has been to give the practicing veterinarian the greatest amount possible of the most useful information available on the subject, within the limits of the space at our disposal—to present in 50 pages an introduction and a guide to poultry practice. The reader will find herein brief, concise, authoritative discussions of the poultry industry's need for men skilled in the treatment and prevention of disease of fowls, the opportunities for poultry practice, methods of starting and building a poultry practice, discussions of poultry culture having a direct bearing on poultry disease, poultry sanitation, hygiene, disease and parisitisms. It is truly a guide to and for poultry practice and the many references to bulletins and more extended articles will enable the interested reader to pursue the subject further.

All credit for the excellence of this poultry practice issue, and it surpasses anything heretofore attempted on this subject, is due to that splendid group of poultry pathologists and practitioners under whose names the articles appear. In this they have done much for those veterinarians who will heed the insistent demand for service to the poultry industry and, indirectly, much for the poultry industry.

Poultry practice pays.

POULTRY DISEASE PROBLEMS

SOME veterinarians have been puzzled and some others do not as yet appreciate the reason why infections and other ailments of poultry have attained such extraordinary importance during very recent years. It has been realized, of course, that the growth of the poultry industry—the large increase in the number of fowl in most parts of the country and large increase in the traffic in birds (and eggs) would account for a vastly greater prevalence of disease, just as the increase in numbers and traffic in other kinds of live stock has seen a great increase in the importance of disease in other food producing animals; but it has seemed that the growth of the poultry industry alone could not account for all of the increased prevalence of infectious disease and parasitisms among domestic fowl.

Doctor Stubbs, of Pennsylvania, in a bulletin reviewed elsewhere in this issue, solves this problem for his readers. Whereas the dairyman who doubles the size of his herd, must double the number of his stanchions, double the size of his cow barn and double the acreage of his cow pastures, or the hog raiser or feeder who increases his operations must provide additional feeding floors, pens and pastures; on the contrary, when the poultryman, particularly in the case of the farm flock, expands his operations, he usually does it with the same equipment. During recent years, this expansion has remained profitable, more so perhaps than any other form of live stock production, and the natural tendency and the result has been continued expansion in the majority of instances as before, without proportionate additional equipment until the poultry business is now commonly conducted in quarters overcrowded

far beyond what has obtained in any other class of live stock.

In addition to this, poultry feeding has been reduced to the semblance of an exact science, and forcing for production is now the rule, with the inevitable result, where carried to an extreme as it often is, of lowering the resistance of the birds to nutritional ailments, to infection, to parasites and to other unfavorable conditions.

Given hundreds of millions of fowl, an enormous traffic in day-old chicks and in older fowl, hopelessly overcrowded quarters and forced production, and the stage is set for—well, just what has happened.

The problem of controlling poultry diseases has become too grave and too complicated to be handled by the producer. For one thing, his time and his energy and his ability are fully occupied with the problems of production, or at least there is a useful field for all the skill he can acquire in the production and marketing phases of the industry. For another thing, as Stubbs[1] has pointed out, the results obtained in disease control depend upon accuracy in diagnosis. Accuracy in diagnosis, and the selection of a proper treatment based upon such diagnosis, depends upon a training in the fundamental medical sciences. Thus, poultry disease control is the field of the veterinarian. The poultryman has not the fundamental training in the medical sciences necessary for such work and, of course, cannot afford the time and expense necessary to acquire it. It is certainly the duty of every veterinarian, practicing in a community where his services may be needed to handle disease in poultry, to avail himself of such special information as he may require to render an efficient service of value to the poultry raiser.

To equip himself with the information and skill requisite to handle diseases of poultry is not beyond reach of the ordinary veterinary practitioner, which is evidenced by the hundreds who are doing this work successfully now. Careful study of a textbook or two on the subject, reading the recent experiment station bulletins on poultry diseases, careful attention to the articles on this subject constantly appearing in the veterinary magazines, and most important of all a first hand study of the material available in his own locality, has equipped many to render a service in the field of poultry practice profitable to their clients and to themselves. At greater expense, much useful information may be acquired at the veterinary short-courses held in various states. Such courses, however, are probably more valuable to the man with some experience than to the beginner.

[1] Poultry Diseases by E. L. Stubbs. General Bulletin No. 453, Pennsylvania Department of Agriculture, Harrisburg, Pa.

POULTRY DISEASE CONTROL

THE World's Poultry Congress held at Ottawa, Quebec, in August, 1927, was a revelation even to the representatives of the poultry industry, in its magnitude. The congress was attended by more than 4,000 members from 42 nations. Among those in attendance were many veterinarians, 24 of whom presented papers before the Congress. Acres of commercial exhibits and the immense live bird exhibit containing pens of prize winners from every corner of the world constituted convincing evidence of widespread interest in the poultry industry.

In poultry production, the United States ranks first among the countries of the world, producing one-half as much as all the remainder of the countries of the world combined. The annual value of poultry products in the United States totals $1,000,000,000 and exceeds that of any other branch of the live stock industry, excepting only the dairy industry and the swine industry. More than 800,000,000 baby chicks were sold in 1926 and more than 2,000,000,000 eggs were produced.

Mohler[1] finds the legal authority granted the United States Department of

[1] The Control of Poultry Disease in the United States, by John R. Mohler, Chief of the Bureau of Animal Industry, U. S. Department of Agriculture. Read at the 64th annual meeting of the American Veterinary Medical Association, Philadelphia, September, 1927. Published in the Journal of the A. V. M. A., Vol. 25, No. 5.

Agriculture to cope with poultry disease on the whole as yet inadequate; but of recent years the Congress has shown a disposition to recognize the needs of the industry for centralized disease protection. He offers the assurance that the organization of the bureau is wholeheartedly pledged to the fullest exercise of such functions as the Congress shall bestow upon it for the safeguarding of the poultry industry.

Continuing the discussion of some of the more important poultry diseases, Doctor Mohler said:

"No disease problem is of greater moment than bacillary white diarrhea of chicks and its corollary, the pullorum infection of hens. The former strikes a deadly blow at the very fountainhead of the industry's young life. A unified organization of state agencies responsible for the supervision and interpretation of standardized tests with proved antigens is essential for the accomplishment of definite, dependable results in controlling this most dangerous infection. This is merely a case of applying the same principle of protection to poultry that has been successful in human medicine and in treating the larger domestic animals.

"There are now on the market certain products which are being used successfully against such diseases as roup, diphtheria and pox, but there are many factors which influence the degree of immunity produced. Such vaccines, of course, should not be used if any other infectious disease is present in the flock. This is one reason why such methods of preventive vaccination should be administered only by a veterinarian.

"Research work in feeding has demonstrated the relative importance of protein, minerals and vitamins in rations for growing chickens and laying hens. Only a beginning has been made however, in respect to determining the proper balance among these proteins, minerals and vitamins. A tremendous field of research is open to the nutritional investigator in working to produce completely balanced and economical rations for our poultry and thereby eliminate many of our nutritional types of disease. The proper method of controlling these various nutritional diseases involves the necessity of distinguishing the symptoms and the application of the particular dietetic treatment appropriate to each form. Thus nutritional roup yields to the feeding of cod-liver oil, green feeds, egg yolk or butter fat, all of which are rich in vitamin A, while in rickets—a deficiency disease involving a faulty calcium metabolism—cod liver oil in the early ration and later an allowance of shell or ground bone constitutes the rational treatment.

"The subject of poultry parasites has received and is receiving a great deal of attention and investigation in general regarding parasitism as a highly important cause of losses among poultry. The losses are especially heavy among chicks, as are losses from parasites among young animals of all sorts.

"Basic research is essential before it is possible to develop adequate control measures or even to recognize the presence of parasites now probably overlooked, even where they are destroying flocks. The growth and concentration of the poultry industry are increasing infections and parasitisms and our excellent transportation facilities are serving to distribute parasites and diseases far and wide.

"The most effective control of poultry diseases in the United States must be based largely on the efforts of poultry-owners themselves, which naturally would include the employment of the veterinarian skilled in poultry diseases. Such control is first an individual problem. And only when individuals cannot or do not handle a dangerous situation is there need for government or state action.

"Each poultry-raising state should establish a competent veterinary poultry service, which should include poultry research laboratories and competent workers.

"Laws and regulations should be

framed with the object of preventing the spread of communicable diseases within a state, the transmission of infection from one state to another, and the introduction of infection from abroad. They should be based on dependable scientific information and not on business expediency nor for the purpose of furthering commercial ends.

"Thorough surveys should be made by the veterinary organizations of each state, at regular intervals, to ascertain what contagious diseases and harmful parasites are present in the state."

Opportunities Afforded for Poultry Practice

1928

By J. M. HENDRICKSON, Farmingdale, New York
New York State Veterinary College, Cornell University

THE field of poultry practice is beginning to beckon to the veterinarian. We see this movement going forward on all sides of us. Poultry subjects are commanding a prominent place at veterinary meetings and conferences. Veterinary publications are devoting large amounts of space, not infrequently entire issues, to poultry husbandry and poultry disease problems; and more concrete than these, the veterinarian in general practice is beginning to "sit up and take notice." He is beginning to incorporate poultry work into his regular practice, and to discuss poultry ailments with the same familiarity as he does those of the larger quadrupeds. One might well pause and ask, "what is the cause of all this?" Unquestionably, there are several factors entering into it. The rather rapid growth and expansion of the poultry industry to hold third rank in the live stock industry of the country; the increase in numbers and concentration of birds has naturally favored disease propagation; the appearance of disease in a flock is an economic loss to the poultryman; and the demand from the poultryman for competent services to obviate this loss, have, undoubtedly, played a prominent part in bringing it about.

The opportunities afforded the veterinarian for poultry practice are, of course, directly related to the extent of the poultry industry in his immediate territory. Certain sections of the country are more devoted to poultry raising than others, and it is obvious that the demand for veterinary service is governed accordingly. The veterinarian practicing in a large city would not expect to come in contact with poultry ailments as much as one practicing in the country. Likewise, the country veterinarian located in an intensive poultry center would have more work of this nature than one located where the industry consists of small farm flocks. However, poultry raising is quite general over the entire country and a large number of veterinarians are in position to render services of this nature to a greater or lesser extent. There are only a few districts where poultry raising is intensive enough to call for a veterinarian becoming a "poultry specialist" and devoting his entire time to poultry practice. In the great majority of instances, the veterinarian must incorporate this field into his general practice, giving it the attention which its importance to his community demands.

In the practice of veterinary medicine as related to poultry the veterinarian has the opportunity of developing and utilizing his greatest skill and ingenuity as a sanitarian. That prevention is far better than cure, is nowhere more true than of poultry maladies. The conditions under which poultry are kept, with concentration of large numbers on very restricted

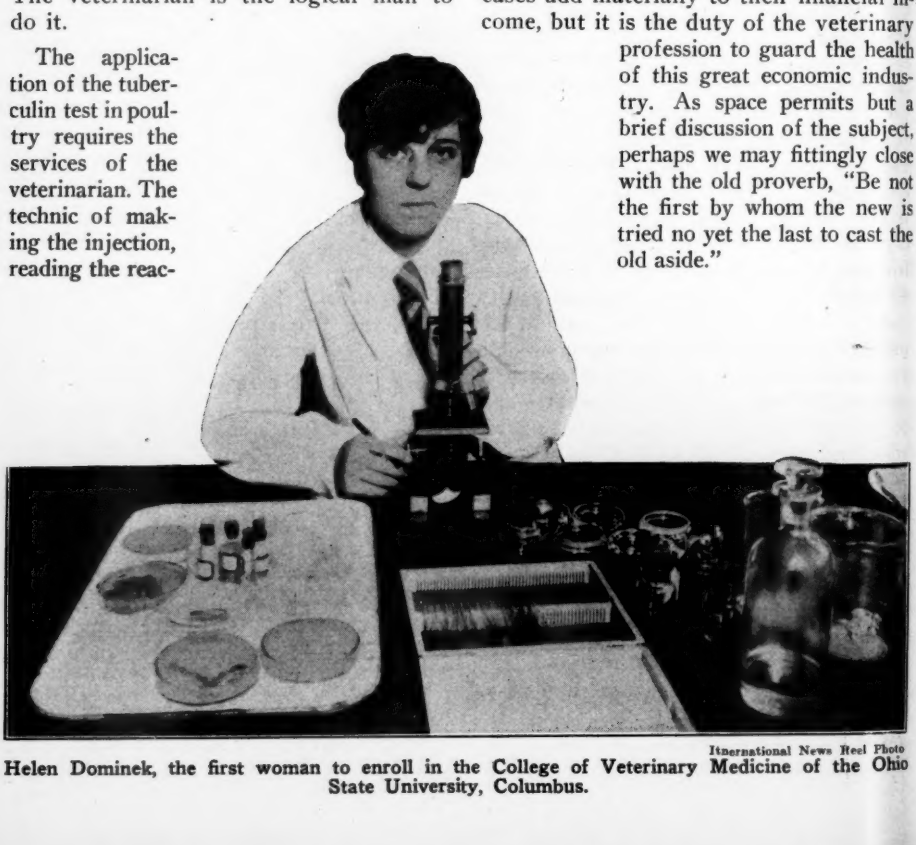
areas, invite the propagation and transmission of parasites and transmissible diseases. Hygiene and sanitation are of paramount importance in the poultry plant, and the veterinarian being trained in these sciences must be relied on to direct their application.

The testing of birds for bacillary white diarrhea is a service which the veterinarian can render the poultryman. The great economic importance of this disease, and the present method of combatting it by means of the blood test, open this field to the veterinarian. He can procure the necessary laboratory equipment, collect the blood samples, run the test, supervise the elimination of reactors and necessary sanitary measures which must follow the test. This work demands the services of a trained man in the field to supervise it, if it is to be successful. The veterinarian is the logical man to do it.

The application of the tuberculin test in poultry requires the services of the veterinarian. The technic of making the injection, reading the reactions, and interpreting the results can only be done successfully by the trained man. The importance of tuberculosis in our poultry flocks is well recognized, as is also the necessity of including it in a successful general tuberculosis eradication program.

There are a great number of other instances where the opportunity is presented the veterinarian to be of service to the poultryman. The field of poultry practice presents as varied problems to be contended with and solved as does the maintenance of health and the treatment of disease in any other class of live stock.

There are too many veterinarians who are entirely ignoring this phase of veterinary medicine which is rightfully theirs. Not only will the poultry practice which may be developed in many cases add materially to their financial income, but it is the duty of the veterinary profession to guard the health of this great economic industry. As space permits but a brief discussion of the subject, perhaps we may fittingly close with the old proverb, "Be not the first by whom the new is tried no yet the last to cast the old aside."



International News Reel Photo

Helen Dominek, the first woman to enroll in the College of Veterinary Medicine of the Ohio State University, Columbus.

Building a Poultry Practice

By E. D. CRISWELL, King City, Missouri

ONE of the most important factors in building a poultry practice, I think is to let your clients know you are interested in poultry and that you are willing and anxious to help them with their poultry troubles.

As poultry practice is in most localities a new thing in veterinary practice, and the poultrymen have been in the habit of buying proprietary preparations or relying on some home remedies, it at once becomes necessary to acquaint them with the fact that their veterinarian is prepared to serve them in the treatment and prevention of the ailments of the poultry flock. For this purpose, I regard it advisable to use local newspapers and announce or advertise, if you please, that you are specializing in diseases of poultry and are willing to help them with their poultry troubles.

I have always advertised that I would make a postmortem examination of chickens and other live stock without charge if they were brought to the office. Poultry carcasses have been brought to me for autopsy from a distance as great as 40 miles.

It is a common thing to come in the office from a call and find several chickens in sacks and boxes with the owner's names on them, and the request for me to post them and report findings or to send what medicine needed.

For the past few months I have been testing quite a large number of chickens for tuberculosis and find that from 17 per cent to 50 per cent are reactors. I find this tuberculin testing to be a good advertisement and the clients are well pleased to have their poultry flocks cleaned up.

I consider the treatment of poultry one of the most important divisions of veterinary practice and one that belongs to the veterinarian, and not the proprietary medicine peddler. The veterinarian has the basic training that fits him for handling it and ample opportunity to acquire such special fitness as may be needed.

It is advisable when on calls in the country to notice the chickens and inquire as to how they are doing and if necessary, to autopsy a few. This is a good time of the year to start in poultry practice, as there is always a lot of trouble with little chickens and you can do your clients a service of very considerable value to them.

Most papers are anxious to get articles on certain diseases of poultry and other live stock and I try to write them up for them to publish. It is a help to them and also a big help to me. I believe in using any ethical advertising to let the public know that I cater to poultry practice. One cannot expect them to call on him if they do not know he is interested in their poultry troubles.

Since there has been so much publicity in regard to the cecal ablation in turkeys, I have had a great many inquiries in regard to the operation. Blackhead has caused a great loss among turkeys in this section. I expect to operate on quite a few turkeys of my own as an experiment to see if I can control blackhead by the operation and also by using clean grounds free from chickens. If you can have success with your own poultry, it builds confidence with your clients.

All of these things have helped to build a desirable poultry practice. I keep a small table and an autopsy outfit in my office and hold all postmortem examinations as far as possible when the owner of the birds is present.

It is common with me to find a lot of poultry in this section badly infested with worms or covered with lice. We also

have a great deal of avian tuberculosis, I believe that eight out of ten farms in this section have more or less tuberculosis on them. If you can show your clients these conditions, they are always anxious to get their flock cleaned up, and back on a paying basis.

I think as much of my poultry practice as I do of my dairy practice or swine practice. A great part of it comes in to the office and keeps me busy during times when there is not much else to do. More veterinarians should specialize in poultry practice, as it is desirable and affords a nice income.

Poultry practice pays.

Establishing a Poultry Practice

By NORMAN W. ACKERMAN, Van Horne, Iowa

THE building of a poultry practice, like many other things, is to be achieved by making it a definite objective to be worked for. The writer has no intention of offering his experience as a criterion to follow, but gives it simply in the hope that it may be of worth to his colleagues who wish to help the poultry raisers in their own communities. There are some who have a liking for poultry and others who do not. To the former it will be a pleasure and the latter simply that of increasing his efficiency in the protection of an industry, the products of which in 1927 exceeded in value one and a quarter billion dollars—"biddy" is the lowly hen no longer.

It has been our practice when on farm calls to engage the owner in conversation about the poultry on the farm. If the flock is an outstanding one in any particular, to compliment the caretaker, usually the wife, on the splendid flock and inquire into the breeding and feeding methods pursued, the extent of success, always advising and encouraging the maintenance of a pure-bred flock, not only because its uniformity makes a more beautiful sight, but because it is more profitable, and, incidentally, the owner will take better care of them and be more prompt to report trouble to me when it occurs. When any trouble has occurred or the flock has not been doing as well as it should, it is good policy to go over the situation and if necessary make a post-mortem examination or two, determining if possible the cause of trouble and making recommendations to correct it, or prescribing a course of treatment to be followed.

The writer was drawn into poultry practice by a genuine liking for poultry, and an appreciation of the long hours of work required to establish a flock and the disappointment of the owner in seeing the results wiped out by disease. It has been a constant practice to encourage clients to bring in affected birds for diagnosis and post-mortem examination. Such examinations are made free of charge and only in case treatment is required is a fee charged for the materials used on office consultation. It has the effect of bringing about a more friendly status between client and practitioner and it makes the practitioner really apply himself to solve the problems offered.

It would be our recommendation that every practitioner purchase several good books on the subject of poultry diseases and study them. A fowl is a thing apart from the other farm animals and requires different handling. It would also be well to subscribe to a couple of the numerous poultry magazines, that in themselves are interesting and are a constant reminder to your client while in your office, that he has a flock at home that may need treatment.

If the practitioner has the time, place and inclination to maintain a flock of his own the client usually places more faith in the suggestions offered, for the average

poultryman is quite skeptical of advice coming from those that are not themselves poultry raisers. It will also bring to the veterinarian a realization of how much he does not know about poultry and will stimulate him in his efforts to offer a satisfactory solution for the cases brought to him. Further, raising pure bred poultry is remunerative, and it has been said, "a hobby is good for any man." It is not a piker's game by any means, and is far cheaper than horse racing. I do not mean that it is essential for a veterinarian to engage in poultry raising; it simply gives him a lot of first hand, practical information, and a far better insight of what methods are the most successful, and a better realization of the many things necessary to raising healthy stock. It is well to have a good practical knowledge of culling, for there is a great deal of this done, and more will be done in the future. For spare time it offers about as much as can be made on the routine of ordinary calls and keeps one in touch with the clients.

I, personally have always regarded the actual practice as a rather non-remunerative business, in which the chief rewards came from increased prestige among clients and the satisfaction of solving the problems confronting the owners. However, I was recently asked just how much my poultry practice paid, and was agreeably surprised upon checking up to find that it is really bringing in far more than I had supposed, and offers a field well worth developing.

Physical Examination and Diagnosis

By NORMAN W. ACKERMAN, Van Horne, Iowa

The equipment needed for field diagnosis in poultry practice are: a scalpel, a heavy knife or bone cutting scissors, a pair of smaller pointed scissors and a pan of clear water.

The examination is usually commenced by first examining the head for deviation from normal that might indicate disease; such as a pale comb, indication of typhoid, tuberculosis, or general debility due to parasites and congestion as an indication of cholera or of being too fat. The condition of the head also being noted for indications of roup or colds, and the mouth for evidences of diphtheretic membranes.

Following this the external surface of the body is searched for parasites such as lice or mites and injuries or infected wounds. Examining the legs and feet for injuries, fractures and bumblefoot or gout.

In making a postmortem examination the bird is laid upon its back, head away from the operator and the legs are separated from the body to the hip joint which is then broken back allowing the legs to drop. Then a transverse incision is made in the skin between the end of the sternum and the anus and the skin is then stripped off of the breast and examined. An incision on either side of the breast is then made separating the breast from the body, and cutting through the clavicle joint and removing the breast intact.

Our proceedure is next to start in at the head and remove the intestinal tract intact and lay it aside. First search the respiratory tract for evidences of pneumonia; gape worms and the nodules of aspergillosis in the young birds. The heart is then removed and examined for hemorrhages and other pathological changes. Pass back to the kidneys and then the liver and spleen, any changes being noted such as enlargement, fatty degeneration, tuberculosis, tumors, etc.

The intestinal tract is examined starting at the anterior extremity and opening it with a pair of scissors, making note of any changes or abnormalities in each region as it is reached. The crop is emptied and examined for impaction, indigestion (sour crop), evidence of poison, etc.,

then the gizzard for foreign bodies or worms. When this has been done slit the intestine full length, watching each section carefully for pathological changes and parasites.

The intestinal parasites of poultry are often very small and in the case of tape worms especially, must be examined in a strong light or they will escape notice. It is a good plan to wash the intestines in clear water and frequently the tape worms can then be found barely larger than a thread, or they may lie coiled up at the attachment to the mucous membrane and will appear like pin head size nodules, that upon straightening out prove to be mature worms. The ascaridae or roundworms are easily found if present.

The cecae, especially in young birds should then be searched as usually they are affected in coccidiosis, showing from a slight irritation to a bloody content or a caseous mass. In a large percentage of birds they are found to be infested with the thread like *Heterakis papillosa,* which are apparently harmless, unless present in extremely large numbers.

The ovaries are frequently the site of tumors and may often be found showing blighted ova as a result of infection with the *B. pullorum* the cause of bacillary white diarrhea. The oviducts often show a rupture with the escape of eggs in different stages of development into the addominal cavity; or the bird may be subject to internal laying, in which case the ova are found free in the abdominal cavity with varying stages of inflammation present. The cloaca is the sacular connection of the intestine and oviduct joining the anus posteriorly, acting as a common passageway for the egg, feces and urine; also serving in the female as an organ of copulation. It may show a rupture or broken egg. There is a condition called gleet, which is an offensive ulceration of the anus, at times involving the cloaca.

At times it is not necessary to make a complete postmortem examination before a cause for death is found. But unless there are indisputable conditions found, it is well to make a very thorough examination to avoid errors as much as possible.

In establishing a diagnosis, all possible information should be considered, feed, care, clinical symptoms, rapidity of death, number of birds affected, in fact everything that concerns the flock should be considered. It is not uncommon to have several conditions present, any of which might cause death, as for instance, roup, cholera, tuberculosis, parasites and malnutrition. It then becomes a problem as to the best means of remedying the conditions found, but the diagnosis itself is not always easy and it may be necessary to base it on the combined findings of several post mortem examinations.

ULTRAVIOLET IRRADATION PROFITABLE FOR POULTRY RAISERS

Harry Steenbock, the altruistic professor of chemistry at the University of Wisconsin, who refused $2,000,000 for his patent on the irradation of food to improve its antirachitic and nutritive properities and then gave the patent to the University of Wisconsin, has completed extended experiments on the effect of ultraviolet rays on the hatchability of eggs.

Irradation of eggs before or during incubation had no effect on the hatchability, but irradation of the hen for a few days before and during the period when the eggs were laid markedly increased the percentages of chicks hatched and also the vigor of the chicks. The hatchability of the eggs was increased at all seasons by irradation, but the greatest increase was in late winter laid eggs when it is common knowledge of poultrymen the hatchability of eggs is lowest of any time of the year.

Another and unexepected outcome of the experiments was the showing that the number of eggs produced was materially increased by ultraviolet irradation of the hens.

Postmortem Examination

By B. A. BEACH, University of Wisconsin, Madison, Wisconsin

Examine the Exterior of the Bird

(a) The skin may show external parasites, tumors, areas denuded of feathers, lacerated wounds or abscesses.

(b) The texture of the skin, the resilience of the feathers, and the weight of the bird are indications of the general condition just preceding death. This, together with the history, frequently enables one to decide whether the disease was acute or chronic.

(c) Observe the head. The nostrils may exhibit viscid discharges due to colds, pox scabs, favus, or swellings due to roup. The comb and skin of the face may be pale in the chronic debilitating diseases such as tuberculosis, intestinal parasitism, or leukemia, also in fowl typhoid and hemmorhage.

Congestion of the comb and skin of the face occurs in hepatitis pneumonia, cholera, enteritis, and inflammations of the internal organs.

Examine the eyes. Blindness accompanies a number of diseases, one of which is coccidiosis. Opacity of the cornea may be seen in vitamine A deficiency (zerophthalmia).

(d) The region of the vent should be examined for evidences of diarrhea, or inflammatory exudates seen frequently in inflammations of the oviduct.

Examine the Interior of the Bird

(a) Dip the bird in water to lay the feathers.

(b) With a bone forcep cut through the angle of the mouth. Examine the mucus membrane for exudates seen frequently in infectious bronchitis, and canker seen in chicken pox, roup and benign canker. Examine the nasal cavities for pus accumulations seen in colds and roup.

The entrance to the larynx is frequently the seat of pus patches which, becoming dislodged, suffocate the bird.

(c) Incise the skin in the median line to the vent and lay it back. Grasp a leg in each hand and break through the hip joint (articulatio coxae). In rickets the costal articulations between the superior and inferior ribs are enlarged and may be seen at this time. In this disease the bones are often brittle, the leg bones may be easily broken.

(d) At this time the esophagus and crop may be examined. With a small enterotome incise the gullet and crop wall. Examine the mucus membrane. A greyish white caseous deposit usually in the form of small nodules is frequently seen in the esophagus and sometimes the crop as well. This peculiar deposit is frequently associated with vitamine A deficiency. This vitamine is found in yellow corn, the leaves of plants, and butter fat. Rations built around white corn may be deficient.

In sub-acute coccidiosis these deposits in the esophagus and crop are also at times seen. A diagnosis based on the presence of these deposits alone, therefore, cannot be made. Examine the contents of the crop. Poisons which color the contents may at times be detected.

(e) The internal organs are exposed by incising the body wall below the breast bone. Note whether fluid escapes from the abdominal cavity. This is sometimes seen in fowl cholera, also some other diseases. The costal articulations may be severed with a knife and the breast bone removed by cutting through the bones of the shoulder girdle with a bone forcep.

Having exposed the internal organs, examine the exposed peritoneum for inflammations seen in peritonitis.

Examination of the Thoracic Organs

(a) Note the cartilagenous attachments between the superior and inferior ribs. In rickets (vitamine D deficiency) these joints are the first to show enlarge-

ments. Other joints may also be involved. With a small enterotome incise the trachea, examine mucus membrane. Inflammation and exudates are frequently present in infections of the upper respiratory tract. Look also for gape worms and growths due to aspergillosis.

(b) Remove the heart. Examine for petechiae and other abnormalities.

(c) Examine lungs *in situ* and then remove. Pneumonias are relatively rare in chickens, except in infectious bronchitis, in which lung involvement is frequently seen. Nodules due to tuberculosis are sometimes seen, more frequently nodules due to aspergillosis are present.

Examination of the Abdominal Organs

(a) Observe the liver, its size, color, and consistency. In fowl typhoid this organ is frequently enlarged, friable, and dark in color. At times also the surface is studded with small grey spots. These lesions are, however, not constant. In fowl cholera the liver is enlarged, soft and frequently contains small whitish spots.

This organ is the seat of important lesions in tuberculosis, enlarged and studded with nodules. In many of the poisons the liver is degenerated. Tumors of the liver are common and are shown by enlargements and changes in consistency, usually the liver is firmer to the touch. Soft livers are seen in nutritional disturbances. In black head ulcers are observed.

(b) Examine the peritoneum. Aspergillosis may be seen in the air sacs. The peritoneum is inflamed and the blood vessels in the omentum injected in peritonitis. Fluid may be present in the abdominal cavity at times seen in fowl cholera, also in peritonitis, and chronic circulatory disturbances. Blood clots are frequently found as result of rupture of the liver.

(c) The spleen is enlarged, firm, and mottled in leukemia. It is enlarged and congested in the septicemias. In tuberculosis the spleen is almost always enlarged and contains nodules varying in size from pin head to a hickory nut.

(d) Remove the gizzard and proventriculus. Examine mucus membrane for parasites. This membrane may be inflamed in is frequently seen especially in the ceca. In cise the gizzard and examine contents for evidences of poisons or foreign bodies penetrating the wall. Remove the lining membrane and look for gizzard worms.

(e) Sever duodenum from gizzard. Palpate intestinal tract the entire length, and note the thickness of the wall of various parts. Petechae are at times seen in the wall. Nodules occur in the wall in tuberculosis and rarely as result of tapeworm infestation. With an enterotome slit the intestinal tract the entire length. Examine the contents for concretions and tumors. Blood is frequently seen especially in the ceca. In acute coccidiosis of chicks the ceca are frequently distended with blood.

Look for both round and tape worms. There are several varieties of both, varying markedly in size. It is sometimes advisable to wash the material through wire mesh. Inspect the cloaca for evidences of vent gleet. Observe the color and thickness of the intestinal mucosa. Look for petechia and other inflammations, the causes of which are too numerous to mention here. A marked thickening of the duodenal mucosa is indicative of some chronic irritation.

In our experience either chronic coccidiosis or infestation with the small tapeworm are the usual causes. Careful inspection will reveal the small tapeworms with the naked eye. They are many times buried in the mucosa. Coccidia, however, cannot be seen without the aid of a microscope. At times the inflammation is so severe that the mucus membrane becomes detached and passes out with the feces. We have never known this to occur except as a result of severe coccidiosis infestation. Where severe inflammation occurs and tapeworms are absent a diagnosis of coccidiosis may be safely made if the clinical manifestations are typical.

(f) After removal of the digestive organs observe the ovary or testicles. The most common testicular lesions seen are tumors and inflammations. It should be borne in mind that during the breeding sea-

son the testicles are normally much enlarged.

The most common ovarian lesions are the presence of misshapen, degenerated, and discolored ova. The usual cause of these lesions is white diarrhea infection. It should be borne in mind, however, that many times such lesions are present and the general health of the hen is not impaired.

The oviduct in laying hens is the seat of much trouble. Hens that have been unduly forced for egg production without proper exercise are more apt to be afflicted. Eversion of this organ is common in such hens. In heavy laying hens the oviduct seems to be the most vulnerable part of their anatomy. Inflammations are, therefore, common. At times inflammatory products and egg yolks fill the lumen of the organ. In some flocks egg production is seriously impaired because of infections of the oviduct. The white diarrhea organism is many times the cause.

(e) Examine the kidneys and ureters. Vitamine A deficiency is characterized by a distension of the ureters and uriniferous tubules with pus. This lesion is constant, and except in sub-acute coccidiosis we have never observed them in any other disease. The kidneys are frequently diseased. With the exceptions noted above, however, there is little that is characteristic.

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The methods of feeding poultry is as important as the kind of feed. Fowls should be fed so that their appetite is not satisfied excepting when they go to roost.

The most common causes, predisposing and exciting, of poultry diseases are, improper breeding, feeding and housing, insufficient exercise and parasitism.

Overcrowding of poultry in housing is one of the most frequent causes of diminished profits. Chickens require not only ample roosting room, but also plenty of range during the day.

INFECTIOUS BRONCHITIS IN POULTRY

In my practice I have in years past had quite a number of cases of diphtheric roup or infectious bronchitis. During the fall of 1924 these cases were much more numerous than usual. Many farmers as well as many packing plants lost poultry by the hundreds at that time from this malady.

The disease begins with a cold, the bird having water or foam in the eyes or perhaps a wet or pasted nostril. The fowl is listless and in a few hours or the following day will choke, and especially if excited or in crowded quarters, will choke violently and may die without much struggle.

The post-mortem findings depend upon the progress of the disease. The upper respiratory tract shows lesions varying from great inflammation to a cheese-like or slimy membrane in the trachea and bronchial tubes.

I have had good results from vaccinating birds with mixed infection bacterins. I vaccinate twice, a week apart, as a preventive. I have found that best results cannot be obtained from a single injection. I increase the dosage on the second vaccination.

In infected flocks, I give Epsom salt, one pound to each 100 hens, in a mash. The next day I begin the use of calcidin (Abbott) in hot mash. If the birds do not eat, I poke from 20 to 50 grains down their throats daily in two or three doses. Birds that do eat get from one-half to two grains in hot mash daily. All affected birds are isolated. Do not be afraid to put the calcidin to them. I have my first one yet to kill with an overdose of this drug.

It is well also to recommend that the client use a hot 3 per cent solution of guaiacol for the worst cases. Dip the head and hold in this solution until a few bubbles appear. Do this a few times morning and evening.

Randolph, Kan. N. A. McCosh.

Value and Limitations of Laboratory Aids in Diagnosis

By T. O. BOOTH, Ft. Worth, Texas,
Laboratory Director, Live Stock Sanitary Commission

LABORATORY examination of specimens for the purpose of diagnosis of disease is a requisite in successful poultry practice. It is a noticeable fact that the veterinarians who have developed successful poultry practices are those who take advantage of laboratory aids. Simple laboratory examinations may be made by the practitioner who has the equipment and the time; however, it is generally more satisfactory to submit samples to a laboratory which is equipped to make any and all examinations and tests and the personnel of which have by virtue of their extended laboratory experience, a better chance of finding the true pathological condition.

The value of the findings submitted to you by the laboratory will depend to a certain extent upon your co-operation with the laboratory. Ordinarily specimens of birds to be shipped to a laboratory should be iced so as to arrive in as normal a condition as possible. Blood for microscopical examination may be dried upon slides and protected from breaking. Whole blood should be placed in a sterile tube or bottle. Blood for test should be iced and allowed to coagulate thoroughly before shipping. Antiseptics should not be used. Always write giving the history, symptoms and other facts pertinent to the specimen. Send live animals if possible, selecting specimens showing typical symptoms.

The diagnosis or statement of findings submitted by the laboratory must be applied to the conditions as evidenced by the flock. Should you upon autopsy find petechia indicative to you of fowl cholera, and send a sample to the laboratory for confirmation and the report is returned negative, you will possibly find acute nicotin poison from the owner's attempt to worm his birds.

Suppose baby chicks die with a white diarrhea. Is it due to *B. pullorum* or to some non-infectious condition? Finding the organism, culturing it, and agglutinating it with a known positive serum is diagnostic of bacillary white diarrhea; however, failure to agglutinate is not positive evidence that it is not the *B. pullorum* as some strains do not agglutinate. Ordinarily finding the typical organism with the post-mortem findings of redish streaked liver, etc., and with a suspicious history would indicate the disease. Pneumonia may be caused by chilling and by overheating. Brooder pneumonia (aspergillosis) should be differentiated by laboratory methods. Runty chicks, foamy diarrhea, a few dying daily coupled with a post-mortem finding of an absence of grit in the ventriculus is self-evident as to the cause and the remedy.

Ordinarily acute coccidiosis can be diagnosed by the symptoms although an earlier diagnosis may be made by demonstrating the coccidia under the microscope. Chronic coccidiosis is however often diagnosed as intestinal worms and a laboratory examination for internal parasites should include search for coccidia. The small thread tapeworm is rarely found except by microscopical examination.

Spirochetosis is transmitted by the chicken tick, blue bug, and diagnosis can only be made by finding the spirochetae in the blood. These organisms however are found in the blood stream only during ascendancy of the fever and quickly disappear after the apex is reached and are not to be found in a bird dead of the disease.

Possibly the greatest use of laboratory facilities by the practitioner is in making agglutination tests for bacillary white diarrhea.

Ordinarily the practitioner can make more money per day taking samples than by tak-

ing samples and running the test also. In conducting the test several points in management and technic must be carefully watched to facilitate the work and maintain the efficiency of the test. The number on the sample must correspond with the leg band number on the bird. The blood must be relatively free from contamination. Lay the tube flat and allow the blood to coagulate up and down the side. In a few hours enough serum will have separated to make the test. Keep the serum cold until ready for use. Ice in the field if necessary. Use only fresh antigen properly diluted, with 8.5% saline solution. C. P. sodium chlorid must be used. A phenol free antigen is more sensitive than one containing phenol. One or two mil of formalin per 1000 mil of antigen should be added just before placing in the tubes. All pipettes tubes and corks should be sterilized with dry heat to at least 185° C. for 30 minutes. After making the dilution with the serum, mix well by shaking and place in an ice box at a temperature between 9° C. and 10° C. for twenty-four hours. Allow to warm up for one or two hours before making the readings. Do not incubate; this keeps down growth of organisms and eliminates necessity of fasting birds. It will not work on cattle abortion tests.

Limitations of the test are governed by the following known facts and possibly others. Agglutination will not occur in early stages of the disease. The period of sensitiveness is not constant in all infected birds.

Immunization with *B. Pullorum* or *B. Sanguinarum* will cause false positive reaction 30 to 90 days after injection.

Infection with *B. Sanguinarum* will cause positive reactions. Old positive serum frequently will not aggultinate except in high dilutions. Less frequently a fresh serum will act in like manner. Agglutination properties of the positive serum may be destroyed by heating to 60° C., by sunlight or otherwise and give a negative reaction when the reaction should be positive.

The Rational Medication of Birds

By B. F. KAUPP, Raleigh, North Carolina

IN THE medication of birds we have a problem quite different from that of the medication of live stock. In fact, the problems of rearing, handling, marketing and other matters in relation are so much different from those of live stock that the more progressive agricultural colleges have separated poultry from live stock, giving it a separate department or division as the college organization may require.

In this article an effort will be made to point out the most rational methods of attack of the problem of giving medicine to birds.

Do Not Drench Birds

In spite of the fact that the bird has no epiglottis, the glottis seems to close tightly during ordinary times in the act of deglutition, but when the bird is struggling the glottis may open at a time when you are pouring liquid down the throat, and thus I have seen more than one fatal attack of pneumonia or of bronchitis follow attempted drenching. The old method of medication of birds was by making dough balls; more modern methods saw this pass to the placing of the powdered drugs in capsules and dipping a capsule in water opening the bird's mouth and throwing the capsule back into the pharynx, watching the bird so that it does not throw the capsule out but swallows it. This has been very successful, or using the ink bag of a fountain pen, passing a wire inside the tube so as to make a balling gun and inserting the capsule in the end of the rubber tube, it will be found very easy to pass the capsule down the esophagus and push it out with the plunger. The most modern way is the making of a prescription

into tablet form and giving a tablet to each bird. This is safe where the dosage must be large and close to the border line and, you might say, is fool proof. It has been our experience that where medicine is not fool proof and it is given for mass medication, trouble may occur by careless use of the drugs and even fatalities result. Modern poultry husbandry means the keeping of two, three, four, or more thousand birds on the commercial farms where disease might appear and be of a serious character and so another method must be found than described above. This calls for mass treatment. By that I mean giving the medicine in the mash or in the drinking water so that each bird will get its amount and no more. To illustrate we will take the matter of medicating for intestinal parasites.

Medication for Intestinal Worms

We have found that one of the worst enemies of the poultry plant is that of intestinal worms. In autopsies of 500 adult fowls in these laboratories we have found that *Heterakis papillosa* infested 31.4% of the birds, taenia 12.8%, *Ascaris inflexa* 29.7%,*Spiroptera hamulosa* (gizzard worm) 19.1%, and other diseases of a parasitic nature included scaly legs 9%, lice 27.6%, and mites 1%. In performing autopsy we can expect to come across some form of intestinal parasites in almost every other bird if they are from different sources. The fact that the worm eggs live so long on contaminated premises, some of them, as the *Ascaris inflexa,* living for more than five years, makes the problem all the more serious. How are you going to medicate 1,000 or more chickens?

Medicating the Commercial Flock

To do this job the medicine may be mixed with the drinking water. In the case of Epsom salt, the cathartic which is best adapted to poultry, it is dissolved in the drinking water. Poultry have a tendency toward constipation in their rather sedentary habits under the commercial factory method and salts (one-half pound to 100 birds) once a month keeps the eliminative organs open. Digestive troubles are the most important of causes of deaths as we have shown in a survey of 500 complete autopsies on adult fowls where 22 per cent were of the digestive tract, 15 per cent septicemic (this high percentage is on account of the fact that fowl typhoid is common in our state and many fowls are sent in for diagnosis), glandular diseases 14 per cent, and nervous 12 per cent.

From these data it will be seen that those veterinarians who give attention to poultry diseases will be called upon pretty heavily for treatment for worms.

When tape worms are present there should be given one grain of finely pulverized thymol to each bird and this can be mixed with the medicine for round worms.

Nicotin is the best drug for round worms and may be given in the form of "Black leaf 40," using one ounce to the 100 hens. If flock medication is used then great care must be exercised to see that all birds eat at the same time so that one bird will not get an overdose for if the overdose be large enough it will constitute a lethal dose.

All birds do not react the same to nicotin, some birds will stand a larger dose than others. To give this medicine, mix the blackleaf 40 with sufficient water to mix with mash so that each bird will have one ounce of mash. With this liquid add one-half pound Epsom salt to each 100 birds. When the mash wet with this mixture is given, it must be given in long troughs so that all birds can get to the trough at the same time. This blackleaf 40 can be put in capsules so that each bird can be given its exact dose, and the Epsom salt then may be given in the drinking water or may be mixed in a dry state with the mash. Use 6.6 c.c. of blackleaf 40 to 16 grams Lloyd's alkaloidal reagent. Mix and fill No. 2 gelatin capsules.

The Use of Iodin in Poultry Practice

Iodin is one of the most useful remedial agents in the materia medica for poultry practice. In abscesses of the feet, of the infraorbital sinuses and in other parts after the cheesy material has been removed, swab the wound and cavity with pure iodin. Ulcerative stomatitis, pharyngitis and laryngi-

tis (of the superior larynx) are quite common among poultry, much of it being due to the chicken pox organism. After the cheesy material has been scraped off, thoroughly swab the part with tincture of iodin. Repeat once a day. In ulcerative laryngitis affecting the superior larynx a curette is often needed to remove the small amount of cheesy inflammatory product that has accumulated at that point. Then swab the part.

Iodin mixed with vaselin, or the so-called soluble iodin sold under the trade name Iodex, is useful in ulceration of the anus and cloaca commonly called vent gleet. Iodin is also used to disinfect the surface before an operation and for wounds.

Poultry Hygiene and Sanitation

By Dr. B. F. KAUPP, Raleigh, North Carolina
Avian Pathologist, Member International Poultry Council

Introduction

THE past twenty years have brought about many new phases in the poultry industry. Especially is this true of sanitation as applied to poultry husbandry. The term sanitation, in a broad sense, might cover the living conditions of domesticated birds. Possibly no greater factor in the health of birds, or in the success of poultry ventures, can be found than in the conditions covered by the term sanitation.

Intensive poultry production has increased the disease incidence among birds. To offset this tendency greater attention is necessary to disease prevention measures. Where any considerable number of birds are brought together on limited ground, disease is certain to appear among them sooner or later. The greater the number of birds kept on a given area, other things being equal, the sooner disease will appear, the more rapidly will it spread, and the greater will be the loss.

On farms of considerable size, where attention is given chiefly to general crops, and but a few fowls are kept on practically unlimited range, the loss from disease may be small, where indifferent, or even bad sanitation prevails, but in intensive poultry plants, where the number of birds is large, and range conditions crowded, there can be no continued exemption from devastating epiornithics if the principles of sanitation are disregarded. Any attempt to operate a plant with insanitary buildings and yards, or under conditions that do not permit sanitation will inevitably result in failure, though temporary success may be obtained.

Site for the Poultry Plant

A rolling, or even moderately steep plot of ground is a desirable location for poultry houses and range. Good drainage is a necessary requirement, and must be provided artificially if the location is such that natural drainage is inadequate.

The surface of the poultry yard should be free from indentations in order that stagnant water will not collect. Dust baths, waller holes, and other depressions which are the product of the birds activities must be kept filled.

The poultry runs and buildings should have a free southern exposure to sunlight, though artificial shade must be provided in hot weather if natural shade is not available. Trees form the best shade, and are cooler on account of the evaporation from the leaves. The trees best suited for the poultry yard are fig, china berry, mulberry, willow, plum, privet, and peach. Tin should never be used for shade because it absorbs and deflects heat. Where corrugated iron is used for the roof and a solid board sheathing is laid down first it will to a certain extent keep out the excessive heat. A very suitable artificial shade may be secured by stretching burlap over a board frame three or four feet high. Shade should always be on a grassy plot. It is advisable to locate the houses, in cold climates, so that they secure the maximum protection from wind-

breaks such as other farm buildings, hedges and orchards. Houses should be located so that a maximum of the sun's rays will be secured in order that advantage may be taken of the germicidal action of direct sunlight.

Buildings and Yards

The soil most suitable for poultry runs is of a sandy composition. Such soil readily absorbs moisture, drains well and dries quickly, all of which are important to ranging birds. A permanent sod should be established on ranges where the double run system is not used. This sod should be of a type of grass adapted to the section. Bermuda, blue grass, and clover or alfalfa can be used where the available range is fifty square feet per bird. The houses should be distributed over the range with one house and not over 100 birds to the acre if the birds are to be used for breeding purposes or are growing pullets on range.

If the available range is too limited, the double yardage system can be used, one yard being sown in rape and oats, or in hot weather in cowpeas or soybeans, while the other yard is being grazed. Rye, wheat and oats are best for winter pasturage with rape and oats in fall and spring. Periodic working of the soil in the range yards is necessary owing to the soil becoming sour, and to the heavy pollution with bacteria and worm eggs voided in the fecal matter.

Just how long such disease germs as entero-hepatitis, coccidia, round worm eggs, Salmonella pullora, fowl typhoid and fowl cholera germs will survive, has never been determined definitely. The North Carolina State College has just completed the first half of its disease research poultry plant on which soil pollution will be studied. With present knowledge we are lead to expect that worm eggs will survive at least five years while fowl typhoid and cholera possibly will die out in a short time; outbreaks that occur subsequently may be due to reinfection from outside sources.

To avoid round worm infestation it is recommended that the brooder houses be made about 10 by 12 feet so that they can be moved from place to place. Three fields are used, growing crops on two while the third is used to brood chicks on. In this manner it will take the fourth year before the ground will be used the second time. Ground will be infested with round worm eggs if infested hens have run on the ground or droppings from infested hens have been scattered on it.

Another way is practiced where poultry production is on an intensive method. The brooder house is stationary and is provided with a cement floor. This floor has ten inches of cinder or crushed rock under drainage and two inches of concrete. There is a yard several square yards in area concreted. This allows the chicks to run out in the sunshine and makes it so that the house and run can be disinfected with a 4 per cent solution of some coal tar dip of a coefficiency of 5 or 6 when the chicks are eight weeks old they can be taken to a clean range with summer range houses.

Nutrition is one of the greatest factors in rearing chicks. Use in the mash 1 per cent biologically tested cod liver oil as well as mineral supplements. Give all feed from troughs especially if disease is among the flock. Change litter every month.

The poultry house floor must be dry. There should be ample ventilation so the birds are comfortable in hot weather as well as in the cold weather. Winter egg production depends wholly on creating spring time conditions which mean comfort, feed and length of feeding hours. The house should be at least 20 feet deep if the length will permit of it. Low damp yards are not healthful. The water supply must be constant and fresh. 55 per cent of the flesh of the growing bird is water and 65 per cent of the egg is water.

Disinfection and Disinfestation

The removal or destruction of parasites is called disinfestation. The removal or destruction of germs is called disinfection. The criterion to the success of disinfestation or of disinfection, is the thoroughness of the procedure. In many instances, these processes are carried through without satisfactory results because the solution will not penetrate masses of litter or fecal matter. The first operation in disinfecting a poultry

house is the thorough removal of all manure, trash and litter. If the nests and roost poles are removable they should be taken from the house and thoroughly disinfected; if not removable, they should be submitted to the same cleaning process as the remainder of the interior. The floor should be scraped and the walls and ceiling thoroughly swept. All accumulated litter should then be removed. All parts of the interior should then be scrubbed with a hot strong lye solution and the building then flushed with a 4 per cent solution of a coal tar dip.

The refuse obtained from the above process should be burned if contagious disease be present.

Disinfection of Yards

Under ordinary conditions the thorough disinfection of poultry yards and runs is hardly possible. The problem may be attacked by yard rotation and the frequent ploughing and turning the soil to allow the hot sun rays to fall directly upon it in the hotter parts of the summer. Where the hot sun rays in July and August heats the soil to a temperature of possibly 129 deg. F. during the day; if continued for two weeks it will do much to kill the worm eggs and work quite a hardship on the contagious germs that have been voided there. The germs and worm eggs that are protected in the house and other shelter must be looked after by thorough cleaning and disinfecting. Soil after a while becomes foul sick and by cropping as in yard rotation there is a tendency to use up this soil pollution. Sometimes it is possible to shift the yard to another part or field on the farm.

Overcrowding Brooders and Range

The average person does not have good luck in crowding too many chicks under one hover or in one building. Best success is attained where the house used is about 10 by 12 feet with a 500 chick size brooder and only 200 to 400 chicks. Health depends in large degree upon vigor of the chick when it comes from the machine. Weak chicks may come from immature parents, or a weakness in the breeding stock or irregularities in the operation of the machine or in handling the chicks in transit. An unabsorbed egg yolk in a chick a week old means that it was of weak constitution when placed under the brooder. Proper living conditions are necessary to success of profit in poultry culture.

Use of Biologics in Poultry Practice

By T. O. BOOTH, Ft. Worth, Texas
Laboratory Director, Live Stock Sanitary Commission

THE use of biological products in poultry practice is attended by the same results that are obtained by the use of like products in other classes of animals.

The successful use of such products, as curative and immunizing agents is primarily based upon an accurate diagnosis of the disease for which they are to be used.

The uses for which biologics are employed in poultry are curative (treatment), prevention (immunizing) and detection (tests).

The curative products used are serums and bacterins. Serums are mostly used in poultry diseases as curative agents although an immunity of short duration (passive) may be established by their use. The serums used in poultry diseases are botulinus serum (anti-toxin), anti-hemorrhagic septicemia serum and anti-mixed infection serum.

Serums

Botulinus (anti-toxin) serum is used as a treatment in botulinus (limberneck) infection with excellent results. It may be used as an immunizing agent in infected flocks but must be supplemented by sanitary measures, feed changes, or whatever may be necessary to prevent further ingestion of the toxin. This serum must be either a polyvalent one or one made from types A and C organisms.

The serums confer an immunity of only

about two weeks duration and in the case of hemorrhagic septicemia and mixed infection must be followed by the use of bacterin or aggressin to establish an immunity. Treatment with the serums for fowl cholera and mixed infection will often result in saving valuable birds which otherwise would have succumbed.

The immunizing products are serums, true vaccines, aggressins and bacterins.

Vaccine

The true vaccine used in poultry disease is the chicken pox vaccine. This is an attenuated virus and immunizes by establishing a mild form of the disease. The majority of birds so vaccinated will be immunized, however some birds, with greatly lowered resistance, will develop the disease in an acute form and may succumb. The vaccine must be potent or little if any immunity will be established. This vaccine may be used during an outbreak in an effort to establish an immunity in the remaining healthy birds. This condition frequently occurs in association with roup and the proper bacterin and serum should be used in such cases.

Aggressin

The aggressin used in poultry practice is the hemorrhagic septicemia aggressin as a preventive against fowl cholera. It may be used early in an outbreak but later, in chronic cholera, the bacterin containing in addition to the avisepticus other associate organisms should be used.

Bacterins

The bacterins constitute by far the most widely used biologic in poultry practice. Bacterins for fowl cholera, fowl typhoid and mixed infection or roup are the most commonly used. Bacterins are used both as immunizing and curative agents, however their manner of usage in the two conditions are very different.

Rarely is one injection of a bacterin sufficient to produce the required result. When using bacterins as immunizing agents a small or sensitizing dose must first be given. This dose should contain from one-fourth to one-half the regular dose of the bacterin. After a period of five to seven days a second dose containing the usual number of killed organisims should be given and after the expiration of a like period a third dose double the second dose should be given. A large initial dose will defeat the purpose for which it was intended, i. e., immunization.

When using bacterins for treatment of birds already infected a large initial dose should be given, at least double the regular dose, to obtain effect, and additional doses may be given but should be smaller in amount of organisms present and be given at more frequent intervals.

Chemically killed organisms are to be preferred to heat killed and bullion cultures are to be preferred to salt dilutions. A relatively weak solution of the organisms, the required number of organisms being present, is to be preferred to the same number of organisms in a concentrated dilution. Immunity by bacterins will be effective for a period of about six to twelve months and breaks or failures to establish immunity will be evident at or near the twentieth day after injection. Autogenous bacterins are to be preferred to stock cultures if their cost is justified.

The most abused, worthless, and at the same time the most worthy bacterin, when it is right, is the mixed infection bacterin avian. This bacterin is mostly an empirical mixture of bacterins of organisms some time found in roup. Some contain four or more organisms and some contain ten or more with the highest percentage of any one being fourteen or fifteen per cent. The majority of these bacterins contain as a base about 50% *B. avisepticus* (*Pasteurella avium*) with generally *Staphlococcus aureus* and *albus* and others in a lesser percentage.

The organisms properly contained in a mixed infection bacterin are the bacteria responsible for the ailment in the individual flock. They may be the avisepticus, the sanguinarium, the staphlococcus and others such as the *B. pyocyaneus, B. Coli* or whatever they may be. First find out what organisms are responsible for the disease or diseases present and then use only those. Biological manufacturers should make up mixtures of

stock bacterins to suit individual flocks or communities rather than one mixture for the whole world. Veterinary practitioners should submit to their laboratories for identification specimens of the organisms involved.

Bacteriophage

Another curative and immunizing product which is not now used extensively is the bacteriophage. It has been used successfully in fowl typhoid, and hemorrhagic septicemia (fowl cholera).

Diagnostic Agents

The biological agents used to detect diseases in poultry are tuberculin, pullorin and pullorin antigen. Their successful use depends upon the experience and thoroughness of the veterinarian using them. Testing with the idea of discovering diseased birds in the flock is to be preferred to testing for ten or fifteen cents. These testing agents when skillfully used and the reactions intelligently interpreted serve a very useful purpose within their known limitations.

Care of Baby Chicks

By NORMAN W. ACKERMAN, Van Horne, Iowa

WHEN the hatching of the eggs is about to be completed, everything should be in readiness to take care of the chicks; this includes brooding quarters, feeding utensils and brooder stoves. The brooder house, assuming that the chicks are incubator hatched and are to be raised by artificial means, should be previously cleaned of all dirt, scrubbed with a hot lye solution and then sprayed with a 5 per cent solution of any good disinfectant such as liq. cresolis. The stove should have been set up and operated for 2 to 3 days to determine its proper regulation. The chicks themselves are the best indicator of proper temperature and will form a ring about the edge of the hover if the heat is correct. The most satisfactory temperature is from 95°-100° F. This temperature should be gradually reduced until weaning time. For best results not over 500 and better only 400 chicks should be placed under a 52-inch or so-called 1,000-chick hover, as these are over-rated in capacity. Care should be exercised not to overheat or chill the chicks as either extreme will bring about a condition closely resembling white diarrhea in symptoms and outcome.

In preparing the brooder house for use it is a good practice to make a frame of 2″ by 2″ material filled with sand to set the stove upon and the rest of the house should have a litter of cut clover, alfalfa or straw, that is free of mold and dust. Peat litter, although highly absorbent, has been reported as unsatisfactory in that it gets in the eyes of the chicks and causes a severe inflammation. The litter should be changed frequently and not allowed to become foul and damp.

After hatching time the chicks should be held in a darkened incubator for 48 to 60 hours after the hatch is half out. This is good practice for several reasons, chiefly that the chicks need the rest and that the first 48 hours of a chick's life is the period in which it is most susceptible to bacillary white diarrhea infection. Be sure that they are properly dried and hardened off before removing to the brooder, which is best done shortly before dark in order to allow time for a feeding and yet not time enough for the chicks to become overtired in their new quarters.

When the transfer is made to the brooder a guard of fine meshed wire about a foot high, set up a foot or so from the edge of the hover, is almost essential to keeping the chicks from straying too far away from the heat; or this may be made with corrugated cardboard, such as is used in shipping merchandise, avoiding any sharp corners into which the chicks may crowd. The area enclosed by the guard to be enlarged from day to day, and it is seldom necessary after 3 or 4

days, the chicks having learned the source of heat by that time.

Feeding too early and too much is the most common source of trouble in young chicks. It is a natural impulse to feed the young well, but nature has provided food for the first few days of life, in the yolk of the egg that is absorbed into the abdomen shortly before hatching. It furnishes all the nourishment for the newly hatched chick for several days. One of the secrets of successful chick raising is to feed little at a time, not more than will be cleaned up in 15 minutes; and feed often—at intervals of 2 to 3 hours. Failure to do this is an invitation to trouble that is sure to be accepted with alacrity. Keep them hungry for the next feeding and active if they are to do well.

It has been demonstrated that whole milk, skim or diluted semisolid buttermilk is the best material to form the liquid part of the diet. It may be either sweet or sour. Very probably its greatest advantage is that of stimulating proper growth and development rather than any bactericidal action on the part of the lactic acid it contains. Milk is a natural animal food and assists growth and proper nutrition greatly.

The drinking utensils used for baby chicks should be of the self-feeder type and made of earthenware, glass or enameled ware. Tin or galvanized material should not be used because the lactic acid dissolves the lead in the galvanizing, making a possibility of trouble.

To summarize the essentials, avoid crowding, overheating, chilling, dampness, mouldy feed or litter and over feeding. Be sure of proper hardening off, sanitary surroundings and plenty of fresh air without drafts. Kill and burn any sickly or deformed chicks before disease gains a foothold and give them all the sunshine and exercise possible. When called to see a flock of ailing baby chicks consider the foregoing before concluding you have an infectious disease to deal with.

ASPERGILLOSIS—BROODER PNEUMONIA

Aspergillosis is a disease of little importance where chicks are handled properly, but it causes heavy losses where the chicks are overcrowded in the brooder, the ventilation poor and the quarters allowed to become damp and foul. Formerly it was more prevalent than it has been of recent years since artificial brooding of chicks has become better understood and more attention is given to ventilation, cleanliness and a proper temperature in the brooder.

The specific cause of the disease—a fungus, *Aspergillus fumigatus,* is universally distributed so it requires only that conditions be unfavorable to the chicks and favorable to the fungus to have an outbreak. The birds inhale the spores which attack the lungs. The effects are usually limited to the respiratory organs. Losses are frequently high in young chicks, older birds are quite resistant and mature fowl are seldom affected.

It is important that white diarrhea be not confused with this disease. Some hatchery men who take no measures to obtain their eggs for hatching from hens free of bacillary white diarrhea, frequently attribute heavy losses in chicks purchased from them to brooder pneumonia, thus attempting to shift the blame for the losses from themselves to the purchaser of the day old chicks for it is well recognized among poultrymen that aspergillosis or brooder pneumonia is a result of faulty management in the brooder.

Symptoms and Lesions: The symptoms are those of a pneumonia, dullness, droopiness, unkempt appearance and difficult respiration. On autopsy, the mold often greenish in color may be seen in the exudate in the bronchioles and in the abdominal air sacs. The mycelia are readily demonstrated under the microscope.

Treatment: Treatment is of little avail. Older birds run a chronic course and usually recover if given good hygiene. Chicks die rapidly. The spread of the disease is promptly arrested by removal of the litter, disinfection of the quarters, and providing good ventilation, proper temperature and dry surroundings.

Baby Chick Ailments

By NORMAN W. ACKERMAN, Van Horne, Iowa

THERE is no group of ailments affecting livestock that require a closer application of the principles of differential diagnosis than the ailments of chicks in the first few weeks of their lives. To be able to correctly diagnose and interpret these conditions requires not only a knowledge of the diseases affecting them, but also the methods of raising that are known to be correct. Many of us have not paid as much attention in past years as perhaps we should, but the time has come when few veterinarians will care to forego the poultry practice that belongs to them, and the correction of baby chick ailments forms no inconsiderable part of it.

The writer is rather at a loss to know just where to begin but will try to cover a number of the more common conditions found and remedial measures as far as possible. To those among us who have not done much in handling these conditions, may I offer a word of caution; unless you are absolutely sure of the cause and diagnosis; be very careful in making a prognosis. If I may cite an instance, the writer was called to investigate the cause of losses in a flock of about 1,500 chicks that were dying at a rate of 50 to 100 a day. To our knowledge the flock maintained by the hatcheryman was infected with bacillary white diarrhea, many of the chicks showed symptoms of this and post-mortem examinations tended to bear out the supposition; yet a guarded prognosis was given, stating to the owner that very probably there was more than one cause for the loss, the outcome being difficult to forecast. These chicks were placed upon a treatment of bichlorid of mercury 1 to 4,000 and combined sulphocarbolates powder, one heaping teaspoonful to a gallon of drinking water. The result was that in three days the losses had stopped, which would not have been the case if bacillary white diarrhea had been the primary factor, and we would have laid ourselves open to considerable criticism for a mistaken diagnosis. What the owner remembers is this: he was kept busy keeping the place in a sanitary condition and that he was given some medicine with the result that the loss stopped. In this connection may I make the statement that in our experience bichlorid of mercury should never be given in a weaker than 1 to 5,000 solution, if results are desired consistently. We have repeatedly given it in 1 to 2,000 and 1 to 3,000 solutions with good results. A solution of 1 to 10,000 which is often recommended is frequently ineffective.

Use Care in Feeding

Perhaps the most common cause of loss is feeding too early and too much, with a resulting high fatality. Post-mortem examination will show an unabsorbed egg yolk in the abdomen and the intestinal tract overloaded. In the first two weeks or so of life be on guard for this and remember that if the chicks are hungry their actions will be unmistakable; also remember, that in the wild state there is but a small amount of food available for the first few weeks. Be very careful of any musty feed; it will cause great damage.

Diarrhea—Common and Specific

Chilling, overheating, whether from too high incubation temperature or in the brooder, simple diarrhea from overfeeding, and bacillary white diarrhea all present about the same group of symptoms. There is no question that bacillary white diarrhea is the greatest individual scourge of the poultry industry today, but when a chick shows pasted up behind, back apparently too short, crop protruding, lack of vigor and the post-mortem shows an

unabsorbed egg yolk, do not jump at the conclusion that bacillary white diarrhea is the cause. Perhaps the fire went out a few nights previously or may be it became extremely hot in the house with a subsequent chilling. The lungs may show reddened or grayish color, but at times it become an impossibility to base a diagnosis on post-mortem appearances. Bacillary white diarrhea has been to easy to say, with the result that many a flock has been unjustly condemned, the true cause being an error in management. However, bear this in mind, if the flock is infected with this disease and is mismanaged, either as baby chicks in transit from a hatchery or in the brooder house, it will be about as easy to check the proverbial fires of the hereafter as to stop the losses in such a flock. All that can be done is to kill and burn all affected chicks, giving the remainder all possible care, including correct feeding and sanitary measures.

Don't Crowd Baby Chicks

Very frequently the beginner will take the manufacturer's word as to the capacity of a brooder. In a few days there is not enough room and losses begin to occur from overcrowding. As the chicks grow see that they are given plenty of room.

Rickets

In their early life, leg weakness is one of the ills liable to develop, and its presence in the light of our present knowledge is inexcusable. The addition of a good mineral or steamed bone meal 5 per cent, with 2 per cent cod liver oil to the ration is all that is required. Leg weakess describes the condition; it is a simple rachitis due to insufficient deposit of bone forming material.

Mycotic Pneumonia

At this same stage in their lives, aspergillosis, mycosis or mycotic pneumonia, as it is variously termed, is not an infrequent ailment. It is impossible to give a detailed description here other than to say that it is due to a type of mold of the genus aspergillus. It takes the course, as a rule, of a fatal pneumonia. Post-mortem findings show whitish nodules in the various parts of the air sacs and air passages, especially the lungs. It is often wrongly diagnosed as acute tuberculosis and is the cause of many unexplained outbreaks of that disease; another error due to snap judgment. The only recourse is to dispose of affected birds. Clean and disinfect thoroughly and be sure that the scratch litter contains no mold. Treatment is without avail.

The Laxative of Choice

If at any time constipation should appear, a simple and effective laxative is a heaping teaspoonful of common baking soda in the drinking water, or Epsom salt, one pound to 400 pounds of chicks, given in the water or mash.

Lice, Mites and Bedbugs

Lice are not much of a problem in brooder raised chicks and under hens they usually infest only the head and neck. A small amount of liquid paraffin applied to these parts will dispose of them, or warm lard may be used. After they are two or three weeks of age they may be dusted with sodium flourid and talcum in equal parts. Mites usually occupy the cracks of the roosting quarters except at night. If these are sprayed with kerosene once or twice a month during warm weather they will cause no great harm. Occasionally an old building infested with bedbugs is used as a brooder house and these will cause material damage if not eradicated.

Cholera and Typhoid of Baby Chicks

Fowl cholera and fowl typhoid not infrequently affect young chicks and are hard to differentiate, not as common as some other ailments, perhaps, but often enough to cause heavy losses. The writer has been using bichlorid of mercury and sulphocarbolates compound. Every peddler, drug store and patent medicine concern is selling "chicken pills." This is different from the ordinary run of patent medicines, which at the present time are a curse to the poultry industry.

Bacillary White Diarrhea

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STATE AGRICULTURAL '28

BACILLARY white diarrhea is an acute infectious disease of young chicks, caused by *Salmonella pullorum*. It is one of the few diseases which is known to be directly transmitted from dam to offspring. The greatest source of danger is the infected hen, which usually harbors the germ in the ovary. Allotted space will not permit a full description of the cycle and no mention will be made of *Salmonella pullorum* infection in adult birds. For a study of this subject a bibliography of three hundred and forty-five references, complete to July 1, 1927, compiled by Dr. W. A. Hooker, may be obtained from the Office of Experiment Stations, United States Department of Agriculture, Washington, D. C.

Symptoms and Pathology

The symptoms and pathology of bacillary white diarrhea in chicks are similar to those of other diseases of chicks. The chicks appear depressed, remain under the hover, peep constantly, the feathers ruffle, and the wings droop. In sub-acute cases, the down around the vent becomes "pasted up" with the white feces, which give the disease its name, obstructing the vent, causing a retention of feces in the rectum, and producing a condition called "pot bellied." Chicks thus affected, utter cries of distress when attempting to void droppings.

The mortality varies from 15 to 100 per cent according to the virulency of the attacking germ and the management of the chicks. Chilling, over-heating, faulty feeding, and exposure due to long shipments tend to increase mortality. Symptoms similar to those described, are noted in other chick diseases also.

History plays an important part in making a field diagnosis. High mortality in previous years or among chicks purchased from similar sources by other persons, and a definite period of incubation with the mortality beginning at the third to fifth day and reaching a peak at the eighth to tenth day, are diagnostic aids. Losses seldom occur after fourteen days. Chicks hatched in incubators containing infected eggs or chicks fed on raw infected eggs are apt to contract bacillary white diarrhea.

The lesions are an ochre-colored liver, unabsorbed yolk, enteritis, impaction of the rectum, and necrosis of lungs and epicardium. Occasionally an impaction of the ceca, which resembles that seen in coccidiosis, is observed.

No attempt to discuss differential diagnosis in detail is made since another article on "common diarrheas" appears in this issue.

Bushnell, *et. al.*[1] reported an experiment comparing symptoms and lesions of chicks artificially diseased by various methods, including chilling, over-heating, bacillary white diarrhea, fowl cholera, and fowl typhoid. Except in the case of the chicks suffering from fowl cholera, the symptoms, lesions, and mortality differed little.

The large number of available avian pathological laboratories enables veterinarians to have a bacteriological examination made of specimens from diseased broods, the only safe way to confirm or disprove field diagnoses of chick diseases.

Control

Treatment of bacillary white diarrhea is practically useless. Intestinal antiseptics are indicated. Sour milk kept before the chicks has been considered beneficial, but marked reductions in mortality from any form of treatment are rare. Darkening the hatching trays during the last few days of incubation, followed by ideal brooding and management methods, aid in lowering mortality.

Bacillary white diarrhea is controlled like any other infectious disease. In addition,

[1] Bushnell, L. D., Hinshaw, W. R., and Payne, L. F. 1926. Bacillary White Diarrhea in Fowl, Kansas Agric. Exp. Station, Tech. Bulletin 21.

we can determine the true source of infection,—the carrier. The cooperation of the veterinarian, various other control agencies, and the client is necessary to success.

The agglutination and the pullorin tests are used to detect carriers of *Salmonella pullorum*. The aggultination test is the older and in the hands of reliable technicians is an efficient aid in control and eradication. The pullorin test is a field test which can be used by the veterinarian and, when perfected, may supersede the aggultination test. In using either test, the managerial problem following the test must be stressed.

The poultryman, often an obstacle in the control plan, must be educated to realize that a report of the test will not free his flock from the disease. He must be taught the necessity of prompt removal and disposal of reactors, followed by a thorough cleaning and disinfection of the premises; not to add non-tested stock in form of eggs, chicks, or adults; to refrain from incubating eggs from tested, with eggs from non-tested birds; to refrain from brooding mixed hatches from unknown sources; and to avoid entering birds at shows or egg laying contests unless they can be quarantined and retested before re-introducing them to the home flock. Finally, he must be impressed with the need for annual 100 per cent testing to insure eradication.

Bumblefoot

By F. D. PATTERSON, Jr., Auburn, Alabama
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BUMBLEFOOT is a term that is applied to a diseased condition of the feet of chickens, characterized by a chronic abscess formation affecting the balls of the feet and surrounding tissue. There are two forms of bumblefoot.

Traumatic Bumblefoot

This form of bumblefoot is caused by the balls of the feet becoming bruised and infected. Infection is secondary to bruising and is not of a specific nature. The organisms most concerned are as a rule the usual pus producing organisms that are found in such wounds. The pus in traumatic bumblefoot is usually caseated and interspersed in the surrounding tissue making it very difficult to remove completely. Surrounding joints may become involved. The foot becomes swollen, hot, and painful, producing much lameness.

The commonest predisposing factors are high perch poles, hard floors, and heavy weight breeds of chickens.

Nutritional Bumblefoot

This form of bumblefoot is primarily produced by heavy nitrogenous feeding. Insufficient green food, lack of exercise, and the light high producing birds are marked factors in bringing about this disease.

Secondary infection as in traumatic type is found. In differentiating the two types we must consider history, weight of bird, diet, etc.

Diagnosis

Clinically the two forms differ in that nutritional bumblefoot is so often complicated with internal disorders of various kinds, and by the fact that we find a more liquid pus, and the pus as a rule is easily separated from surrounding tissue, whereas in traumatic bumblefoot the pus is caseated and separates from the tissues with difficulty. In the traumatic form large birds are the most often affected by far. It is seldom seen in light breeds. In nutritional bumblefoot the reverse is true; this form being nearly always found in S. C. White Leghorns. In the nutritional form many birds in the same pen are affected. Birds not subjected to high nitrogenous diet and close confinement are not affected. The traumatic type occurs in one or just a few individuals. Diet and range has little to do with its occurrence.

Prevention

The traumatic type is prevented by using low roost poles and having floors well padded. The nutritional type is prevented by regulating diet and giving plenty exercise. An abundant green food supply is very important.

Treatment

Remove all caseated and otherwise diseased tissue surgically, and apply tincture of iodin, three per cent mercurochrome or other suitable antiseptic. Severe hemorrhage is controlled by packing and bandage. The incision should be made over the point that apparently is most affected.

The diet must be corrected in nutritional type if results are to be at all favorable.

Perch poles and floors must be corrected if results are to be beneficial in the traumatic form.

"Leg Weakness"—Rickets

By C. C. PALMER, University of Delaware, Newark, Delaware

THIS disease derives its name from its most prominent symptom, "leg weakness." The name is fairly satisfactory, but since it has been shown it is really the same as rickets in mammals, it is advisable for the professional worker to employ the latter term.

Importance and Distribution

Rickets as a disease of young growing chicks is practically unknown on farms where it is still the practice to raise chicks by natural incubation and brooding. Under conditions of natural incubation and brooding, the hen brings forth her brood at a season of the year when climatic and nutritional factors are favorable for the normal growth of the chicks. With her brood, the hen spends the greater part of the day in the direct sunshine, receiving the beneficial ultra-violet rays which are essential in the activation of the antirachitic vitamin (vitamin D).

This method of flock production, however, possesses numerous economic drawbacks, and is being replaced by artificial incubation and brooding. In order to develop the new flock for fall egg production, the eggs are incubated during late winter, or early spring, and the chicks are raised under artificial climatic conditions in heated brooder houses, where they do not receive sufficient ultra-violet rays. (These rays cannot pass through ordinary window glass). The earlier the hatching season, the greater the danger of the chicks developing rickets.

As artificial incubation and brooding is now being practiced extensively throughout the United States, rickets has become an important disease and extensive losses will occur unless poultrymen provide their growing chicks with a ration rich in the antirachitic vitamin, or in some way supply the birds with ultra-violet light.

While the disease is best known as a disease of young growing chicks, it has been reported occurring in mature birds, particularly in young laying hens which are kept housed during the winter months.

Cause and Symptoms

It has been demonstrated that the type of "leg weakness" which occurs so commonly in chicks kept inside during the late winter and early spring is the same as rickets in mammals and that it can be prevented in the same way that rickets can be prevented, that is, by either including the antirachitic vitamin in the feed or by exposing the chicks to ultra-violet light either from the sun or a quartz-mercury lamp.

Early hatching and artificial brooding are, therefore, predisposing causes in that such chicks may be deprived of direct sunlight. Another predisposing cause which may be a factor in causing rickets in young chicks is the use of eggs for hatching purposes obtained from hens which did not receive sufficient ultra-violet light.

Work has been carried out at the Kansas Station[1] showing that ultra-violet light plays

[1] Hughes, J. S.; Payne, L. F.; Latshaw, W. L.; Poultry Science; 1924-1925; IV; PP. 151-156.

an important rôle in the production of normal eggs, just as experiments have shown it to play an important rôle in the normal development of the growing chick. The beneficial action of the light was not manifested alone in the number of eggs produced but also in the chemical composition and hatchability of the eggs. It is believed that ultra-violet light enables the hen to produce the antirachitic vitamin and in this way enables her to put more of it in the egg, and that it is this lack of vitamin D in the egg which is responsible for eggs of low hatchability and that an egg deficient in the antirachitic vitamin will not develop a strong vigorous chick. Study shows that the amount of sunshine just preceding and during the time the egg is being produced is one of the factors in determining its hatchability.

Chicks suffering from rickets usually have a lowered blood calcium and phosphorous content. If the calcium and phosphorous content is normal, assimilation will be prevented, resulting in abnormal bone formation. The lack of mineral deposits in the bones is often accompanied by arrested development of the soft tissues of the body.

The disease usually develops in chicks if they are kept inside until four weeks of age. In mature birds it usually does not become noticeable until the birds have been confined for two or three months. Loss of the use of the legs ("going down") is the most pronounced symptom in both young and mature birds. Affected birds lie on their sides, the legs failing to support the weight of the body. In mature birds the "leg weakness" may be only temporary, lasting for several hours and followed by apparent recovery. When the disease is present in laying pullets there results a decrease in egg production, and increase in the number of thin and soft-shelled eggs, and the temporary paralysis of the legs which is frequently followed by spontaneous recovery after laying an egg.

One of the most striking symptoms, aside from the "going down" on the limbs is a "buckling" or inward curvature of the ribs at the junctions of the vertebral and sternal portions, associated with a distinct lack of rigidity of the distal portion of these bones.

Diagnosis and Treatment

The diagnosis of rickets is usually easy in advanced cases. Early diagnosis, before the birds "go down" is more difficult, but may be accomplished by examining a number of chicks in the flock from time to time to note the progress of bone development. Enlargements of the ribs, especially at the costo-vertebral junctions, are of very common occurrence and furnishes a good guide in the early diagnosis of cases. In such cases it is likely to be the only gross evidence of the disease. Flexibility or softness of the mandibles, specially the lower mandible, is evident in chicks showing arrested bone development. Johnson[2] recommends the examination of chicks in the flock from time to time to note the progress of bone development. If the diagnosis of rickets is made early, the losses may be lessened materially by applying early relief measures. In mature birds the post mortem examination reveals changes confined to the bones and parathyroid glands. The bones are softer and break more easily than normal. Enlargements, of the ribs, at the costo-vertebral articulations are well developed. The ribs may present fracture lesions in this region. Doyle[3] has called attention to the greatly enlarged parathyroid glands in this disease, in mature birds.

It has been demonstrated that an exposure of ten minutes to ultra-violet light from a mercury arc light or a few hours in the sun light per day prevents leg weakness in growing chicks on a diet on which similar chicks not receiving the light treatment will develop weak legs.

Adding substances rich in the antirachitic vitamin to the feed of young growing chicks or young hens which are kept closely housed will prevent the disease. Adding cod liver oil of good quality to the ration to the extent of one-half of one per cent will prevent the disease.

[2] Johnson, W. T.; Poultry Science; 1924-1925 IV; PP. 55-61.

[3] Doyle, L. P.; Poultry Science; 1924-1925; IV; PP. 146-150.

Green Feed Deficiency in the Poultry Ration

By C. A. BRANDLY, Manhattan, Kansas
Contribution No. 102 from the Department of Bacteriology, Kansas Agricultural Eperiment Station

NO ESSENTIAL part of the poultry ration is as commonly deficient or entirely lacking as that of green feed.

Green feeds supply all the vegetable material necessary for metabolism and are rich in essential minerals and vitamins. They furnish in easily assimilable form the necessary elements in which grains and animal matter are poorest. Green foods favorably influence skeletal development in making possible a better storage and assimilation of minerals, particularly calcium.

In addition to supplementing the other parts of the ration they tend to adjust the body for the most economic and efficient utilization of food. These properties are largely attributed to their high vitamin content and the favorable nature and arrangement of their mineral constituents.

Fresh green feeds provide moisture and bulk to the intestinal contents which are necessary in promoting healthy activity of the body processes.

Grain and animal proteins are acid forming in character and without adequate neutralization tend toward a condition of acidosis. The base forming character of the green feeds enhances their value in overcoming the high acid production resulting from rations containing an excess of protein. Green feeds are, therefore, invaluable in preventing and overcoming too great a deviation in the acid balance of the body. Green feeds are the most satisfactory and readily available sources for supplying the several vitamins essential for the health of poultry.

In addition to these advantages, green feeds obviously afford variety in the diet and increase its palatibility. These factors in relation to growth and production are alone of considerable significance.

In short, we may summarize the qualities of green feeds as follows:

1. They provide a cheap and readily available source of all the vegetable elements necessary to a complete diet.
2. They are rich in minerals and vitamins.
3. They have a favorable influence upon growth and development.
4. They equalize or balance food assimilation.
5. They act as buffers or stabilizers of acid balance of the body.
6. They furnish moisture and bulk to the intestinal contents.
7. By supplementing the diet to complete the ration, health is induced and promoted and disease resistance enhanced.

The ideal sources of green feeds are the green thin-leafed plants. Certain factors such as lack of moisture or lack of sunlight during growth decrease their food and vitamin value. Direct sunlight is necessary for the maximum content of minerals and vitamins. Plants grown under glass or without sunlight are of little value in supplying these essential elements. Leaves having the function of storage tissues for food for the plant are of less value as sources of minerals and vitamins. Thin leaves are active organs of metabolism of the plant and consequently possess higher nutritive and accessory properties. The legumes and grasses are widely used as satisfactory green feeds for the poultry ration. Lettuce and sprouted oats are used during

the winter season when other green plants are not available. These substances may be low in the essential elements when they are grown under glass and are very light in color. This lack of chlorophyll indicates that normal growth and assimilation has been interfered with and such plants cannot be considered as satisfactory green feed.

Fresh green feeds, however, are not essential for the health of poultry if an adequate supply of properly cured green feeds is provided.

By adding a liberal supply of good green feeds to the average ration many difficulties encountered in poultry feeding are overcome.

The ill effects of slightly inadequate diets may not manifest themselves directly or outwardly and for this reason improperly nourished individuals may be in the "danger zone" of disease. Its effect upon the individual especially in the case of breeding stock has a profound influence upon the fertility and hatchability of the egg and the livability of the chicks. The chicks from inadequately fed flocks are much more subject to unfavorable conditions and disease. Baby chicks may show indications of "deficiency" diseases when there is no outward evidence thereof in the parents.

Characteristic changes or lesions often appear when the diet is deficient in the necessary elements. It is doubtful, however, whether an uncomplicated deficiency disease ever occurs in any animal. Vitamin deficiency diseases, "avitaminoses," are deficiency diseases as far as the vitamin factor is concerned. Often mineral metabolism is also affected in these cases.

Common manifestations of disease resulting from a diet deficient in satisfactory green feeds are:

1. Unthrifty appearance with dull rough feathers.
2. Nutritional roup, or ophthalmia.
3. Alternating diarrhea and constipation.
4. Leg weakness and paralysis.

Nutritional ophthalmia, or roup, differs from ordinary infectious roup in that it is seldom complicated with pyogenic or putrefactive organisms or processes. On autopsy of birds with nutritional ophthalmia characteristic white nodules of the esophagus are often noticed. Urates in the form of white flaky deposits may be present in the pericardium, the liver and the peritoneum. The kidneys are usually light in color and distended with urates.

Diarrhea is caused by a more or less severe enteritis resulting from the highly acid nature of the intestinal contents. Paralysis of the legs, wings and even the neck is commonly found in severe cases of deficiency disease. Leg weakness varies in extent and severity depending upon the progress of the disease process. Leg weakness may be associated with rickets.

Prevention rather than treatment must be considered the best means of combatting disease induced by deficient green feed. However, upon manifestation of such diseases successful treatment can often be instituted.

Epsom salt is useful to clear the intestinal tract of irritant material, and the flock should also be provided with an adequate supply of fresh water to which a quantity of suitable antiseptic is added. It has been observed that "force" watering of badly affected birds has brought about a rapid and marked improvement.

The addition of buttermilk may be of considerable value in changing the intestinal flora from putrefactive to fermentative type. Good green feed at this stage tends to correct intestinal and assimilative conditions. Cod liver oil may be used to advantage in that it is rich in vitamin D, the antirachitic factor. Green feeds are considered as possessing little of the antirachitic factor but cod liver oil alone will not prevent or correct rickets unless certain essential mineral elements are present. The green feeds supply these elements in adequate quantities.

Limberneck (Botulism) in Fowls

By A. J. DURANT, A.M., D.V.M., University of Missouri, Columbia, Missouri

LIMBERNECK in its strictest sense is a disease caused by a preformed toxin produced by *Clostridium botulinum*, an organism which was first isolated from spoiled sausages; therefore the name botulism.

This disease affects all classes of poultry but is more common in chickens, in which it often causes the loss of a majority of a flock in a very short period of time. The most characteristic symptom of the disease is a limber neck, though in advanced cases there is a complete paralysis of the entire body.

The disease is more likely to occur in the hot summer months after a rainy spell than other times, though it may occur at any season of the year—depending somewhat on the source of the infection.

Cause

The micro-organism is commonly found in spoiled canned foods or decaying carcasses of animals; rarely, ordinarily poultry feeds have been known to contain this organism and produce the typical limberneck disease in flocks in which it was fed. Spoiled canned beans, spoiled string beans, spoiled canned corn, and various other vegetables have caused large losses when fed to poultry flocks.

It is probable that the disease occurs more frequently as a result of chickens feeding on dead carcasses of farm animals, such as hogs, other chickens, and sometimes rats which have been allowed to lie around after death. It is not uncommon for chickens to die with typical limberneck symptoms when they have eaten maggots which have developed on dead carcasses. Not all maggots produce limberneck symptoms when eaten by chickens; it is only those that have fed on the carcass of animals which contain the disease. Many poultrymen report that their chickens have been killed by eating maggots for this reason.

In one outbreak of this disease, in which typical symptoms of limberneck were present I investigated this case and found a barrel of chicken manure which contained enormous numbers of maggots, and on which some of the flock of chickens had fed. Concluding that this was the source of the limberneck I fed large numbers of the maggots to healthy chickens, without reproducing the disease. A change in the mash which was being fed to the affected chickens promptly stopped the occurrence of cases in the flock.

Symptoms

In mild outbreaks of the disease the first symptom that is usually noticed is in the morning a few of the birds may remain on the roosts, some of which when in a standing position, their heads will hang perfectly limp in a pendulous position in front of the body—complete loss of tomcity in the neck muscles having developed. Some birds may show only a slight paralysis, in which the neck will be "bowed" at a rather sharp angle about the middle. This condition is caused by a paralysis of the neck muscles, which let the neck hang limp. (See Fig. 1).

In severe outbreaks of the disease sudden appearance of several cases of typical limberneck in the flock is usually the first indication of disease. A bright red comb, rough feathers easily pulled out, and a limber neck are probably the most characteristic symptoms of the disease. Usually large numbers of the flock are affected at once and are found lying in a prone position. When picked up they will utter a cry of pain and the feathers will almost fall from the body. A subnormal temperature is sometimes present. A watery or whitish diarrhea may be present and the skin, soiled by this discharge, may appear red and congested.

Often, when a bird dead from the disease is examined, the crop may contain a number of maggots and bits of decomposed meat. Sometimes the crop will be filled with spoiled corn or other

food that has carried the toxic material. The losses from this disease will vary anywhere from five per cent to ninety-five per cent in a flock unless measures are promptly instituted for its control as soon as the disease is first noticed.

Differential Diagnosis

There are several conditions which the practitioner might mistake for true limberneck or botulism. There is a condition known as wry neck in fowls, in which the neck is twisted or held to one side, but does not have the limpness found in botulism or true limberneck. Wry neck may be due to worm troubles, to infection of the middle ear, or to severe intestinal disturbances, due to organisms or foreign bodies other than the one producing true limberneck.

Another condition which may be easily mistaken for the last stages of true limberneck is a form of malnutrition, as a result of exclusive grain rations being fed to poultry. In cases of this disease there is a generalized paralysis and the bird is in a comatose state—helpless, with eyes closed—remaining in this condition for two or three days. There is labored respiration. This condition may be distinguished from limberneck by the fact that the birds live longer, and the history shows exclusive grain rations being fed, and the lack of any paralysis of the neck muscles as distinguished from paralysis of the entire body.

In the early stages of limberneck there is no loss of power of movement of the body muscles but just a loss of movement of the neck muscles.

Prevention

The prevention of this disease is the most important in its control. The poultryman should be urged to feed a liberal, well-balanced ration at all times to his poultry flock—a ration which should contain 20 per cent of protein. Birds which are fed a liberal, well-balanced ration are much less likely to pick up foods which may contain the organism which produces limberneck. The farm should be carefully gone over and all dead or decaying animal meats should be burned or deeply buried, or any spoiled canned vegetables which may have been thrown out to the poultry should be searched for and removed.

Birds affected with limberneck in the early stages before complete paralysis had occurred. The bird on the right has the typical bowed neck in which only half of the neck is affected. The bird on the left has lost entire control of the head and is resting it on the floor. The one on the right made a nice recovery under treatment. The one on the left died from the disease.

Treatment

All affected birds should receive as soon as possible a brisk purge. A simple one which has given good results in the writer's hands is from a half to two-thirds ounce of castor oil containing about one-third dram of turpentine. This may be administered conveniently with a dose syringe containing a nozzle four or five inches long, which may be easily passed down into the crop of the bird, and obviates the danger of strangling. Strychnin, in small doses, has been recommended but is impractical, because of the fact it should be administered at least three times a day. If the purgative is administered early enough in the disease most of the birds treated will make a good recovery, and it is surprising how rapidly recovery takes place.

Fowl Paralysis

By I. E. NEWSOM, Fort Collins, Colorado
Colorado Agricultural Experiment Station

IN recent years a paralysis of fowls generally occurring in the first winter and affecting birds from 3 to 15 months of age has become increasingly common.

In 1921 Kaupp[1] described a fowl paralysis as commonly occurring throughout the eastern half of the United States, showing few, if any, gross lesions but exhibiting microscopic evidence of a myelitis. This observation was confirmed by May, Tittsler, and Goodner[2] in Rhode Island in 1925, who regarded the disease as the most serious affecting the mature fowl in that state.

Doyle[3] in 1926 seems to have been the first in this country to stress the swellings of the nerves in the brachial and lumbosacral plexuses as characteristic of the disease, and as a consequence he called it neuritis.

Apparently the disease as described by Doyle was already well known in Germany, where it had been described by Marek[4] as early as 1907 and in Holland by Van der Walle and Winkler-Junius[5] in 1921.

Pappenheimer, Dunn and Cone[6] in a bulletin of the Connecticut Experiment Station not only confirmed the gross nerve lesions as described by Doyle but added a new series associated with an increase in the lymphatic tissues of the body. In one flock especially they found a large percentage of tumors mostly starting in the ovary but metastasizing to various organs and giving on section typical pictures of lymphosarcoma. Believing these to be an integral part of the disease, they suggested the name of neurolymphomatosis.

Cause

Parasitism.—Since with the increase in poultry flocks parasitism has increased considerably and since in many of these cases both round and tapeworms might be discovered in considerable numbers, fowl paralysis was early attributed to infestation with animal parasites. That parasites, particularly tapeworms, will so deplete the bird as to cause a leg weakness and a disease at least simulating paralysis, there can seemingly be no doubt. But it quite early appeared that there were many cases of paralysis that did not show any excessive parasitism.

Vitamine Deficiency.—As the study of vitamines was at its height many stations in the investigation of these accessory food factors discovered that certain forms of paralysis might result from their absence. As a consequence, paralysis was not infrequently considered an avitaminosis.

Vitamin B deficiency or polyneuritis had been rather thoroughly studied in fowls in connection with beriberi in man and the symptoms were well known. Incoordination of motion and inability to maintain equilibrium were among the most prominent. While these symtoms

were very striking in fowls in which the disease is artificially produced, yet Vitamin B is so commonly present in the food of chickens that it is doubtful if this disease ever occurs naturally.

On the other hand, Vitamin A deficiency is not uncommon in fowls during their first winter, especially where there is a shortage in green food. While this will produce a leg weakness it manifests itself particularly as nutritional roup associated with a greyish deposit in the conjunctival sac, a discharge from the nose and the presence of numerous small white nodules in the mucous membrane of the pharynx and esophagus. It is easily controlled by the addition of green food.

Vitamin D deficiency occurs more especially in chicks from a few days to a few weeks old and is not commonly seen in older birds. Sunlight, of course, will prove effective in controlling this form of leg weakness. Of these food troubles the deficiency of Vitamin A seems most likely to be diagnosed as fowl paralysis.

Coccidiosis.—A number of workers found in these typical cases of paralysis a rather severe enteritis confined largely to the duodenum and showing the presence of numerous coccidia. Beach in California and Stafseth in Michigan have been among those holding the view that a chronic form of coccidiosis was quite prevalent in our flocks and that it was responsible for paralytic symptoms in birds.

A Neurotropic Virus.—Practically all workers have attempted transmission experiments which have been uniformly negative whether by inoculation or by feeding. Cultures and smears have also failed to reveal an organism that could be considered as an etiological factor. In spite of these findings, however, most investigators believe that a neurotropic virus is at the root of the trouble.

Symptoms

The symptoms as usually described are first manifested by a difficulty of locomotion or a drooping of one wing. It may be that the disease comes on suddenly and the bird will merely be found on the floor of the house flopping about and unable to maintain orderly progression. The symptoms usually progress to the point where the bird is unable to move from place to place but it may remain alive for many weeks or in some instances for months.

There seems to be an incoordination of motion rather than a complete paralysis as muscle action in the affected limbs may be quite strong but apparently purposeless. Other than the paralytic symptoms the bird may appear entirely normal and eat and drink well.

On the other hand, blindness in one or both eyes is not infrequently found. Gradually the color of the iris in the affected eye changes to a slate grey which is very apparent to one making even a cursory examination.

Occasionally the head is held in a peculiar position, often simulating wry neck. Gradually wasting takes place and death results in from a few days to a few weeks. Spontaneous recoveries have been known to occur.

Lesions

Birds dead from paralysis not infrequently show no gross lesions whatever. Atrophy of the affected muscles is not marked and emaciation is present only as the bird has shown inability to obtain food. More recently a swelling and thickening of the nerve trunks, particularly in the brachial and lumbosacral plexuses, has been described. It would be interesting to know just how constant these nerve lesions are since they were not mentioned by the earlier workers, and although we have made a careful examination of every case of paralysis coming to our laboratory during the past three years, we have not observed them. Nodules are also at times seen on the roots of the spinal nerves.

Microscopic examination of the affected nerves and of the spinal cord shows a round cell infiltration. The view expressed by the Connecticut workers that lymphatic tumors in various parts of the

body are associated with the malady seemingly needs confirmation, since lymphosarcomata have long been recognized in birds as a separate entity.

The eye lesion is essentially a slowly progressing iritis.

Treatment

Since it is apparent that fowl paralysis is quite certainly not due to any single cause a careful examination of the conditions present is the first essential in the management of any particular case. History, symptoms and lesions must be available in order to eliminate well known causes of this condition.

If parasites be present recommendations for their elimination must be made regardless of the presence of paralysis. If glaring dietary deficiencies are apparent these must be corrected. A diagnosis of coccidiosis will probably require laboratory examination, although any severe inflammation of the duodenum in a mature fowl showing symptoms of paralysis would suggest this as the causative agent.

Coccodiosis can be best handled by a rigid sanitary management which includes frequent removal of the droppings. Symptoms of coccidiosis are not apt to be present unless considerable reinfection takes place and reinfection occurs only under conditions of bad sanitation. Whether milk diet is effective in handling the disease in mature fowls as it is in those a few weeks old seems not to have been determined.

Having eliminated these well known conditions there remains only the neuritis, lymphosarcoma and the disease which still shows no lesions. Since no cause has been determined for these conditions and since recoveries are not very common it is well always to advise destruction of paralytic birds as fast as they appear in the hope that the disease can be stamped out by this means.

Where the loss is high as in a case that recently came to our attention, where it ran to 30 per cent in one season, elimination of the strain seems desirable since there is a possibility of hereditary transmission. In a few flocks the mortality has been quite high but ordinarily it does not run to exceed 2 or 3 per cent.

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BUTYN IN AVIAN SURGERY

The sensorium of the fowl is so poorly developed, except in the region of the head, that an anesthetic is usually not necessary except for operations on the head and appendages. Operations for ingluvotomy or gonadectomy seldom cause the bird noticeable pain or marked concern. Ablation of the wattles or drainage of the paranasal sinuses on the other hand appears to cause the bird a great deal of discomfort.

For use as local anesthetics Nonidez reports that cocain or morphin have proven absolutely valueless. We have not had opportunity to try these drugs. A 1 per cent solution of Butyn injected at the base of the wattles and dropped into the eye has apparently produced a diminution in sensibility.

The outstanding features of sinus operations are pain and hemorrhage. When practical a 1 per cent solution of Butyn may be used as a local anesthetic. Good results have also been secured with ether or chloroform as general anesthetics for sinus operations. It is a more common practice, however, to use sufficient restraint and dispense with the anesthetic. The advisability of using an anesthetic must be left to the judgment of the operator.

Kansas City, Mo. Sivert Eriksen.

Common Diarrhea of the Fowl

By S. J. SCHILLING, Fayetteville, Arkansas,
Associate Professor of Veterinary Science, University of Arkansas

TO the layman diarrhea is a disease; to the physician or veterinarian it is a symptom—a symptom primarily of enteritis. Diarrhea is a condition in which feces are voided with abnormal frequency and in an excessively liquid state. While diarrhea may appear before there are demonstrable lesions of the intestinal tract it cannot long persist before these become apparent.

In some diseases enteritis results from a specific cause and diarrhea becomes a symptom of the corresponding specific disease. This is true in bacillary white diarrhea, fowl cholera, fowl typhoid, coccidiosis, and other parasitic infestations. The appearance of diarrhea in a flock should focus attention to the possibility of the presence of one of these specific diseases and a positive diagnosis as to cause should be established. Enteritis may, however, be non-specific in origin, may be the principal or only pathologic finding and diarrhea the earliest or only definite symptom observed in the sick bird. In popular terms then this form of enteritis has been called a diarrhea and it is the object of discussion here.

Symptoms

In fowls especially, a close distinction can not be drawn between diarrhea and the laxative state. The two merge into each other. The urine and the feces become more or less mixed in the cloaca and the discharges tend to be rather soft. Moreover, certain feeds tend to be laxative without necessarily causing an inflammation. Any definitely marked laxative state which may be traced to an inflammatory condition of the bowel or other organ is a diarrhea.

We observe in birds having an enteritis and showing a diarrhea frequent excessively liquid passages of feces a tendency for feathers about the vent to become soiled, matted together, and in the chick the accumulation of excreta may become dry and entirely occulude the vent. There frequently is an increased viscidity of the discharges and the plumage is extensively soiled. Accompanying diarrhea other symptoms such as loss of appetite, depression, loss of flesh, fever, decreased or suppressed production may be found. The prominence of the symptoms depends on the duration of and the severity of the enteritis which caused them.

Pathogenesis

There are three immediate cause of diarrhea. They are excessive peristalsis, retardation of absorption of water from the bowel contents and excessive secretion of fluids by the mucous membrane lining the bowel. The last factor is highly important, rarely is wanting and is somewhat varied. Excessive secretion may virtually become an extravasation of lymph and blood plasma and thus be highly debilitating. The extravasation may be marked by profuse secretion of mucus and prominent lencocytic migration into the lumen of the bowel as in catarrhal enteritis, and in the severe injuries to mucous membrane and to capillary walls the escape of red cells—i. e., hemorrhage into the bowel, which follows, may give rise to a bloody diarrhea.

The inciting causes of enteritis and thus of diarrhea are varied. In the baby chick a diarrhea frequently is seen as the direct result of chilling. We are all familiar with the fact that chilling results in congestion of the lung and that in such cases copious amounts of fluid from the blood vessels extravasate into the tissues and into the alveoli, producing edema of the lung. The condition if severe leads to more lasting pathological conditions

which we call pneumonia. A similar train of events frequently occurs in the bowel. Congestion of the submucosa of the intestine follows from chilling of the external surface of the body because the resultant decrease of volume of blood in peripheral vessels causes a corresponding increase in volume of blood in internal vessels.

The mucous membrane of the bowel becomes edematous and absorption of liquid gives way to copious secretion or extravasation. Thus the contents of the bowel become more fluid than normal. Meanwhile the nerve filaments ending in the intestinal mucosa are irritated and they send stimuli which result in vigorous perisaltic movements. By this mechanism diarrhea is produced. If the congestion is severe or prolonged, and if the epithelial cells are greatly damaged or if their resistance to infective agents is reduced a catarrhal squamative, ulcerative, hemorrhagic or other enteritis may ensue.

The chick is also subject to enteritis and accompanying diarrhea when fed too early, too heavily, or with coarse or high protein feed. We used to say a chick should not be fed for 48 or 72 hours after hatching in order to give time for the absorption of the reserve yolk which it contains at hatching time. More recently, however, experiments which the writer helped to conduct showed that the rate at which the reserve yolk is absorbed varies greatly as between chicks and in the five-day chick rather large quantities of yolk may still quite regularly be found. It is safe to assume that a chick should not be fed earlier than necessary to maintain strength and vigor so that it may be as mature as possible before its intestinal tract is taxed at all, and then should be fed lightly with gradually increasing quantities in order to give the optimum opportunity for the establishment of the normal bacterial flora of the intestinal tract. Heavy feeding or feeding with coarse feed or feed which is readily fermentable or is high in protein favors the multiplication of putrefactive bacteria, and tends to lead to enteritis.

Diarrhea of the Adult Fowl

The adult fowl, on the other hand, is liable to an enteritis and a diarrhea not seen in the chick. Thus ovarian infection with peritonitis is common in adult birds, and this frequently leads to enteritis, the inflammation extending to the lining of the bowel by contiguity or being induced reflexly by excessive stimulation of the sympathetic nerves. Again, broken eggs in the oviduct lead to infection of that structure and of the cloaca. This infection frequently extends up the large bowel by contiguity and again enteritis and diarrhea appear. Moreover, nephritis accompanied by diarrhea among heavily producing hens on high protein feeds is not rare. One may find the soluble constituents of the urine precipitating out and choking the ureters or accumulating in the cloaca in masses that resembles old brittle mortar. In nephritis itself diarrheas are induced since the intestinal mucosa attempts to compensate for the suppressed excretory function of the kidney. And in nephritis with the accumulation of urinary deposits in the cloaca an inflammation of the latter organ results which inflammation again frequently causes diarrhea. The inflamed cloaca itself may set up a diarrhea by reflex stimulation of the bowel higher up.

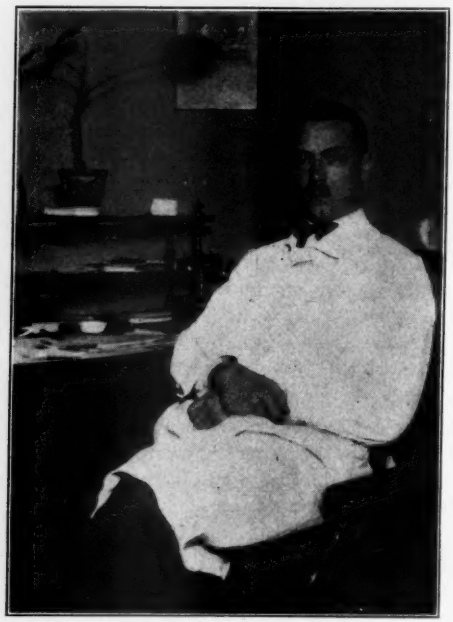
The writer has seen no case of so-called vent gleet that was not directly attributable to nephritis, to disease of the oviduct as from broken eggs, or to a chronic enteritis higher up in the intestinal tract.

The other non-specific causes of enteritis may be found in old and young birds alike. They are largely due to feed and to stagnant water, *abrasive feeds* such as oats, in which the hulls have too much scouring action, *acrid feeds* which because of original composition or fermentative changes have come to contain chemical irritants and *feeds excessively rich in protein* which tend to undergo putrefaction or cause nephritis. Excessive feed will frequently lead to diarrhea since it tends to cause permanent enlargement of the caliber of the bowel, which in itself tends to cause a disturb-

ance in the balance between bowel content and surface area of secretive and absorptive epithelium in contact with the same.

Treatment

Treatment for enteritis characterized by diarrhea should be preventive by avoiding the obvious causes. The first dictum in any disease is "Remove the cause." Treatment should also be corrective. Rest of the bowel is a treatment for enteritis as well as rest of the inflamed joint is a treatment for spavin; the feed should be reduced and high protein feeds such as laying mixtures especially are to be restricted. Since the enteritis always tends to be or to become of an infectious



Prof. Franz Benesch, Tierartzlichen Hochschule, Vienna, Austria, who introduced epidural (caudal) anesthesia to the veterinary profession of Amercia at the Lexington, Kentucky, meeting of the A. V. M. A., August 1926. Prof. Benesch is now investigating the economic value of Veronoff grafts in sheep.

nature, internal antiseptics are indicated. Here the buttermilk diet is the premier treatment. Buttermilk may be given in the liquid solid, semi-solid, or dry form, the former being preferable. Clabbered whole or skim milk is equally good. All of the water intake of the fowl may well be replaced by some form of sour milk. Drugs are not as valuable as internal antiseptics as might be desired; they show no discrimination and check the development of desirable bowel inhabitants as well as that of the undesirables. An exception may well be made for lactose or milk sugar, if you will class this as a drug. It enables a desirable bacterial flora to gain foothold and flourish in the bowel, restoring the bacterial balance. Other drugs which have shown some merit are one teaspoonful of catechu per gallon drinking water and one teaspoonful of formalin to a similar quantity of the same. The other methods of treatment, however, are superior.

A 10% solution of sodium silicate is an efficient preservative for eggs.

The mortality rate of adult fowls varies from 5% to 15% annually.

Baby chicks should not be fed until they are two to three days of age. Many digestive disorders and particularly non-infectious diarrhea of recently hatched chicks are the result of improper diet and excessive feeding.

Poultry breeding records when properly made, are of considerable value but unfortunately there are few such records. There is a need at this time for a standard systematic record of poultry breeding.

The most efficient poultry house should be dry, free from drafts and so constructed that there will be an abundance of light (sunshine), warm in the winter and cool in the summer.

Trap nests are of value in not only determining the high producing hens but also the loafers. By use of the trap nests and elimination of low producers, profits are increased.

Sources of Avian Tuberculosis

By C. P. FITCH, University of Minnesota, St. Paul, Minnesota

AVIAN tuberculosis is most often introduced into a flock by purchased birds usually adults. Experimental work undertaken at the University of Minnesota does not indicate that baby chicks are an important source of the introduction of this disease. The eggs of tuberculous fowls do sometimes contain avian tubercle baccilli. They are found however in less than one per cent of such eggs. The hatchability of eggs from tuberculous fowls is less than that from normal individuals. Furthermore the hatchability of eggs artificially infected with tubercle bacilli is less than of those not so infected.

A total of 697 chicks were hatched from a season's production of over 2,000 eggs from 88 tuberculin reacting hens. Of this number 487 died and were subjected to a most careful bacteriological examination. The other 209 were tuberculin tested and autopsied. Tuberculosis was not found in any of the chicks.

We must recognize however, that eggs artificially infected with tubercle bacilli, may and sometimes do hatch. For this reason we cannot deny the fact that it is possible that an egg affected with tubercle bacilli might hatch and produce an infected chick. We do not believe that this occurs very often. Evidence derived in the experiments mentioned above bear out this contention.

It was shown further by the autopsy findings of the 88 hens mentioned above that approximately 90 per cent of the infection was very mild, and further that a large number of tuberculin reacting hens failed to produce eggs.

In our judgment the active source of infection in a flock is the old adult hen. Surveys conducted in numbers of flocks show that the percentage of tuberculosis in poultry under one year of age is very small. For this reason veterinarians should advise their clients to dispose of birds over sixteen months old. They will in this manner remove from their flocks the most active source of the spread of the infection. Of course along with this should go advice as to hygiene and sanitation, and placing the younger birds in clean surroundings.

The experimental work conducted at the University of Minnesota, shows that tuberculosis organisms artificially introduced into eggs multiply during the ordinary process of incubation. This would lead one to believe that if an egg contained a few tubercle bacilli naturally placed there by the tubercular hen, that the number of organisms would multiply during the incubation process. This fact makes it imperative that eggs which have undergone incubation, should not be fed raw to live stock especially poultry and swine.

It is known that pigeons and sparrows as well as other wild birds are occasionally infected with tuberculosis. It cannot be denied therefore that this group is a potential source of the introduction of tuberculosis into a flock. For this reason alone it is not advisable for farmers to have large flocks of pigeons or sparrows closely associated with their poultry.

It has not yet been shown that tuberculosis of cattle is a source of active infection to the poultry flock, nor has it been demonstrated that infected swine are a fertile source of spread of the disease to poultry. It should however be kept in mind that hogs are often infected with the avian organism, and as such are a potential source of infection to the poultry flock. It is good farm hygiene not to have poultry associated with the other groups of farm animals. This is not only for the protection of the poultry flock, but more especially for the protection of the other groups of animals and particularly the hogs.

Avian Tuberculosis Control

By ELMER LASH, Des Moines, Iowa
Veterinary Inspector, Bureau of Animal Industry

THERE are many conflicting opinions concerning methods for maintaining our poultry flocks free from tuberculosis, resulting in puzzling the busy practitioner as to what to recommend to his client when asked for advice on the subject. The following suggestions are, therefore, presented:

General Procedure

First, it is not practicable to recommend the tuberculin testing of all the birds in the average farm flock because the cost of the number of tests required to eradicate the disease would be greater, in most instances, than the value of the flock. The disease can be diagnosed by clinical inspection and postmortem findings on 50% of the farms in some sections of the midwestern states. It is suggested that when a practitioner makes a call, he inquire of his client about his poultry, and suggest that they look the flock over. In case no diseased birds are found, and the owner is interested in further determining if the disease is present in his flock, a check test may be made on a dozen or more of the older and more suspicious looking birds. These birds should be injected and kept in the coop until they are examined, 48 hours later. Many times a farmer can induce a number of his neighbors to have a check test made on their flocks at the same time.

These suggestions apply to the average midwestern farm flock. The owners of fine purebred flocks and large commercial flocks can well afford to pay for the services of a practitioner to make the tuberculin test on the whole flock when tuberculosis is suspected.

Importance of Sanitary Grounds and Houses

Let us now consider the location of the lesions in the tuberculous hen in order that we may better understand certain factors which must be considered in cleaning up the flock. Lesions are most often found in the liver, spleen, and walls of the intestines. Thousands of bacteria are, therefore, constantly being passed in the droppings. The average range of a chicken is only a few rods from the poultry house, and the grounds soon become teeming with bacilli. It is, therefore, very important that the chicken house be moved to a new location, as it is next to impossible to make a satisfactory clean-up of an old polluted chicken yard, especially if the ground is not well drained. If a large commercial flock is under a veterinarian's supervision, recommendation should be made to provide two or three separate yards, which should be used alternatively, and the unused lots plowed and planted to some crop, as the poultry house is usually too large to be moved.

When tuberculosis is found in the average farm flock, the best plan to follow is to raise a new flock on clean ground, much like the McLean County plan for raising swine. The old flock should be carefully culled, and all unthrifty birds slaughtered and burned. The remainder of the flock should be sold for slaughter in June or July, after the laying season is over. A clean house and clean ground must be provided for the spring hatch when they have outgrown the brooder house. Remember, it is poor business to raise a healthy flock of young chickens on clean ground and then dump them into the old, polluted, disease-reeking chicken house just before winter.

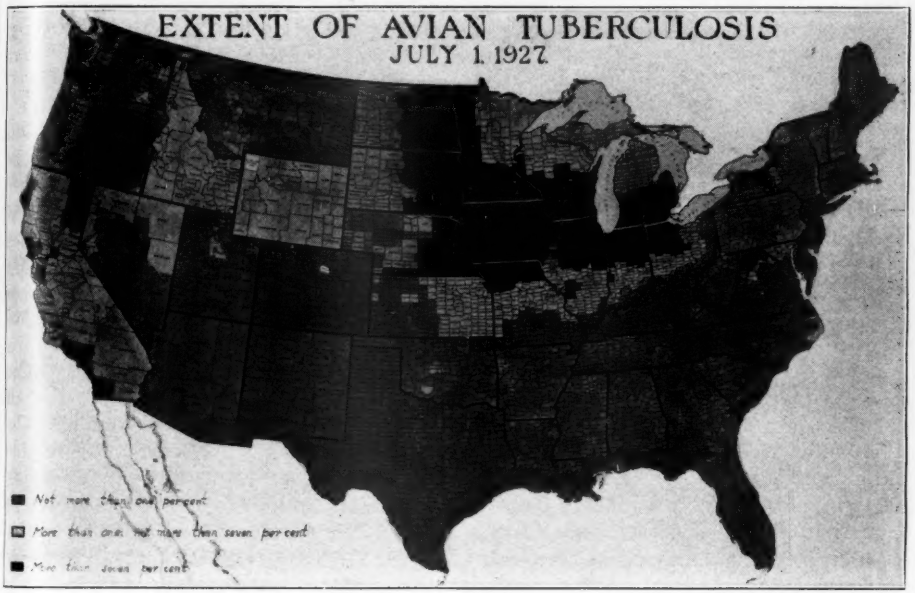
The client should be advised not to keep mature hens more than one year, as pullets will lay one-third more eggs than older hens, and most of the infection is found in old birds. In fact, tests made in a number of townships on an area basis indicate that approximately 20 per cent of the older birds were infected, while not more than two per cent of the young birds were diseased.

Avoid Overcrowding

Caution clients against overcrowding houses and runs. The average farm can carry 150 hens in a colony house 20 by 25 feet very satisfactorily. Such a house can be built in two sections. A larger flock provides greater opportunity for the spread of disease. In case a client expects to operate on a basis greater than 150 mature birds, recommend to him that he build his poultry houses at a considerable distance apart if he intends to give the fowls the run of the place, as is the customary practice on most midwest farms. Urge that dropping boards be installed and kept clean, and that the poultry house for the older birds, as well as the young, be moved once each year.

The accompanying map shows that avian infection is widespread in the Corn Belt of the United States. In some townships in the dark area avian tuberculosis has been found on 80 per cent of the farms where all the poultry were tested under the area plan. When reactors were "posted" 10% to 15% of the cases were generalized.

I urge the practitioner to give more attention to avian tuberculosis, as he can be of great assistance in the campaign. This will reflect to his credit.



Are eggs infected with *B. pullorum* safe for human consumption? By general observation it is apparent that if pullorum infected eggs are injurious to the human, there would be an abundance of evidence to that effect. However, the large majority of eggs are cooked before consumption. There is always a possibility of injury from the consumption of infected food, but pullorum infected eggs is of little signficance as a public health problem.

Goitre in fowls is rather uncommon. An occasional case has been observed. The condition may be prevalent in some areas but has not been called to the attention of veterinarians.

Tumors occur in approximately 9% of all fowls. Like in other animals, tumors occur more frequently in the old birds; thus less than 7.5% of birds under two years of age are affected with tumors and 19% of birds over two years of age are so affected.

European Fowl Pest

THIS destructive disease of nearly all domestic and many wild birds, widespread in Europe, has invaded the United States but once—in the fall of 1924—and was eradicated during the summer of 1925. Great precautions are observed to prevent its reintroduction, but as the possibility of its getting by the barriers and flaring up to menace our poultry industry is always present, it is important that every veterinarian be informed as to its nature, symptoms and lesions and be able to recognize it promptly. Early discovery is all important in the eradication of a disease of extreme infectiousness, such as this one.

Symptoms: European fowl pest is extremely infectious, spreads with great rapidity, runs a rapid course, and the mortality is very high. It is easily the most destructive disease of chickens and turkeys, water fowl are less susceptible.

At the outset of the disease, there is a high temperature, sometimes up to 111° F., entire loss of appetite and marked depression. The bird is droopy and apt to hold the head to one side and to turn in a circle, walking is difficult and paralysis often ensues. The feathers, of course, are ruffled and the bird presents an unkempt appearance. The comb and wattles swell and become dark; there is a thick, sticky discharge from the eyes and nostrils often gluing these organs shut. In the less acute cases a similar exudate may occur throughout the trachea. The exudate gives rise to wheezy breathing and to shaking the head in an effort to dislodge it. Suffocation may result from a filling of the trachea with this exudate.

The affected bird usually lives two to five days, sometimes six days and more, rarely as long as seven days. It is by no means unusual to see a bird apparently well at night and find it dead in the morning, or even apparently well in the forenoon and dead in the afternoon.

Diarrhea is not a common symptom but does occur in some cases having acute intestinal involvement.

Lesions: Doctor Mohler[1] describes the autopsy finding in European fowl pest as follows:

"On post-mortem examination, one may find no lesions at all, on account of the suddenness of the death. In the less acute cases, that is, in those that live for three or four days, there is found a mucous exudate in the nostrils, larynx, and windpipe with blood-stained patches and sometimes blood clots in the windpipe. The lungs are usually more or less pneumonic. A hemorrhagic condition is found on the crop and under the skin in various other parts, sometimes accompanied by a gelatinous substance. Hemorrhagic spots on the muscle and sac of the heart, on the gizzard fat, on the outer surface of the small intestines and especially on the inner lining of the two stomachs, the glandular stomach and the muscular stomach, or gizzard, are typical of fowl pest. You may find these little hemorrhagic patches along the entire intestinal canal, with considerable catarrhal condition, and when that is marked the bird has a profuse diarrhea; but this is not always present. A serous flluid is sometimes seen in the heart sac, or in other cases in the body cavity."

Control and Eradication: The poultry industry can no more afford to have European fowl pest become permanently established here than the dairy or beef industry can afford foot-and-mouth disease. The great losses it has occasioned the poultry industry of various European countries are evidence enough of the wisdom of keeping it out of the United States, if we can, and of promptly suppressing it at any cost if and when it does invade our poultry flocks.

Medicinal treatment is useless and no immunizing agent is known. Entire reliance for control and eradication must depend upon prompt slaughter of affected and exposed birds and thorough disinfection of infected premises. This of course entails in

[1] European Fowl Pest in the United States, by John R. Mohler, Chief of the Bureau of Animal Industry. VETERINARY MEDICINE, Vol. XX, No. 2, February, 1925, pp. 57-58.

anything more than the most localized outbreak, extensive embargoes on the shipment of fowl and the disinfection of vehicles in which fowl are transported, closing down of poultry packing plants, a disturbance of the market and loss in many ways. That such losses may be kept down as much as the circumstances permit, cooperation of state and federal livestock sanitary authorities, transportation agencies, the poultry industry and practicing veterinarians is necessary.

The discovery of a disease suspected of being European fowl pest calls for a prompt report of such suspicions to the livestock sanitary authorities.

Blackhead

By E. L. STUBBS, Philadelphia, Pennsylvania
School of Veterinary Medicine, University of Pennsylvania

BLACKHEAD or entro-hepatitis is the most prevalent and most dangerous disease of turkeys. It is a very fatal disease and most flocks of turkeys, which experience losses, show blackhead.

The raising of turkeys in the same manner as other fowls is frequently attended with difficulties. This has led to the belief that the turkey by nature is not well suited for domestication. Turkeys raised under domestic conditions become just as tame as any other fowls and much evidence shows that there is nothing in the nature of the turkey which unsuits it for domestication. Little study has been given the relation of disease to failures and evidently many of the difficulties in turkey raising have been due to disease.

Blackhead is so named because the head frequently takes on a bluish-cyanotic color. This disease manifests itself as an infectious disease and is characterized by distension of the ceca with necrotic material and by the formation of yellowish or yellowish green necrotic areas in the liver.

The causative agent in blackhead is a protozoan parasite. It has been called by some the *Ameba meleagridis,* while others have called it a flagellate. The organism is round or oval in form with a single contoured outline. The structure appears homogenous throughout with the exception of a granular area eccentrically located and representing the nucleus, enclosing a nucleolus.

Young turkeys are very susceptible, young chickens are only slightly susceptible. Greatest losses occur during the first two or three months of life. The proportion of birds which becomes affected and the mortality varies with the age, usually becoming less, with increasing age, after three months. Mortality in turkeys is very high and in some cases all young turkeys die.

Symptoms

Turkeys only a few weeks old may die suddenly, without showing any symptoms. Usually the affected birds are slower in their movements and lag behind the flock. Some are found with the head drawn in. The appetite is diminished, the feathers ruffled and the wings pendant. Usually there is a diarrhea, the droppings being soft and yellowish or the color of sulphur. Loss of appetite, unthriftiness and lessened activity, leads to progressive emaciation. The head may present a darkened or purple appearance hence the term blackhead.

Lesions

The morbid anatomy in this disease is most noticeable in the ceca and liver. The organisms are most frequently found in the intestine and infection evidently takes place from the ceca. The blackhead parasite gains entrance through the mucosa and multiplies rapidly. It causes the mucosa to be thickened and covered by a necrotic exudate. The tissues are injured, blood vessels weakened with more or less oozing, which mixes with the contents, to undergo degeneration, with the formation of a cheesy core. Enlargement of the ceca, a thickened wall and the possible presence of a cheesy core are the gross changes noted. The or-

ganism also gains entrance to the liver. The liver becomes enlarged and contains grayish, yellowish or yellowish-green spots. These areas of degeneration appear on the surface of the liver in more or less circular form and of varying size. No elevation of the liver surface is present as is the case in tuberculosis or sarcomatosis. At times, instead of spotted changes, the degeneration may be more or less diffuse. The protozoa occur in these areas.

Treatment

A great number of remedies have been suggested for the treatment of blackhead, but none so far has been found to be satisfactory. The insidious nature of the disease with the parasites imbedded in the intestinal wall and in the liver make this disease almost immune from the influence of curative agents.

Ipecac because of its fatal effect on ameba has been recommended. Two teaspoonful doses of powdered ipecac have been given in the mash of each 20 turkeys twice a week as a preventive. It is recommended to be given from the time the turkeys are two weeks old until they are three months old, after which it can be reduced to one teaspoonful every ten days. It has also been claimed that tincture of ipecac in five-drop doses three times daily has been valuable for the treatment of affected birds.

Astringents have been recommended as one-third teaspoonful of crude catechu to each gallon of drinking water. Dr. E. E. Tuzzer of the Harvard Medical School has experimented with many materials for the treatment of blackhead. Tryparsamide was the only product found to be of value. One dose of 4 cc. to 22 cc. of a 25% solution or up to one gram per two pounds weight of turkey has been recommended given intravenously or subcutaneously. It should be given at the first appearance of the symptoms.

Prophylaxis

Prevention of this disease is difficult because turkeys range over large areas. If turkeys are protected from infection they do not contract blackhead. Blackhead can be introduced readily by infected stock. Added stock should therefore be obtained from flocks which have had no trouble and should be isolated, for at least thirty days, before being added. Once the causative agent gains foothold, trouble occurs year after year. Its ravages are usually much worse in sections where the land is low and wet.

The disease is usually contracted by the young turkeys ranging on ground infected by the droppings of carriers of the parasite. This parasite passes from the intestine in the encysted or resistant stage. When the encysted forms are taken into the alimentary tract by feeding, activity begins. The resistant covering is discarded and forms developed from the central mass, penetrate the mucosa, especially the ceca, and are also carried to the liver. Thus the birds become infected through contact with the contaminated material in feeding.

At one time during the investigations it was thought that the cecal worm of fowls, *Heterakis papillosa,* was necessary for the transmission of blackhead. It was believed that this worm injured the mucous membrance and made a portal of entry for the blackhead organism. The disease has been transmitted by feeding cecal worm eggs to young turkeys. However, Dr. Tyzzer has been able to produce blackhead without either worms or eggs, so there are other methods of transmission.

At the first indication of infection, affected birds should be destroyed and premises cleaned and disinfected. Yards should be cultivated and limed. Natural rearing increases the difficulties. Artificial rearing has been successful. Turkeys not exposed to infection remain unaffected.

Blackhead has been considered comparatively rare in chickens. Young chickens have been found showing the lesions of necrosis and ulceration in the ceca and the areas of degeneration in the liver. Older chickens have occasionally been found affected. Blackhead does not run through flocks of chickens as it does through flocks of turkeys. The symptoms and post mortem findings in chickens are quite similar to those found in turkeys, especially the cheesy core which is found in the ceca.

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Medicinal Agents Used for Parasites of Poultry

By ALVIN BROERMAN, State Laboratories, Reynoldsburg, Ohio

THE economic importance of the parasites infesting fowls is increasing with the growth of the poultry industry. Parasitism can be prevented or controlled. Treating the entire flock at one time is usually popular with the poultrymen, but much greater accuracy of dosage is assured when drugs are administered to the individual bird. The cost of the medicinal agents used for poultry must be carefully considered, otherwise the expense of treatment may be too great.

The most desirable time to treat fowls for intestinal parasites is in late autumn, when pullets are placed in winter quarters. The pullets are seldom in heavy production at this time and the least harm will result from handling the birds. Treating for internal and external parasites at the time of culling is also a practical procedure.

Round Worms

Nicotin sulphate and carbon tetrachlorid have been recommended by the California Experiment Station for the removal of round worms (*Ascaridia lineata*). Carbon tetrachlorid is considered very efficient and adult fowls are given 3cc in a gelatin capsule. Nicotin sulphate is less expensive and is often administered in capsules. Nicotin is too toxic to be given alone and is therefore mixed with Lloyd's Alkaloidal Reagent. Each capsule contains 0.12cc of 40% nicotin sulphate and about 0.3gm. of Lloyd's Alkaloidal Reagent. The gelatin capsule prevents absorption of the nicotin before it reaches the intestinal tract. Round worms are usually removed within two days.

Oil of chenopodium, one of the better vermifuges, is frequently used for the small round worm (*Heterakis papillosa*). A treatment for the cecal worm ,which was effective in experiments by the U. S. Department of Agriculture, Bureau of Animal Industry, consists in a rectal injection of oil of chenopodium in a bland oil, such as mineral oil or cottonseed oil. The dose for fowls weighing 1½ pounds is 0.1cc of oil of chenopodium in 5cc of a bland oil. Birds weighing three pounds or more receive about 10cc of this mixture. The two ingredients must be thoroughly mixed and injected into the rectum with an infant's enema syringe, or by other suitable means. The syringe should be passed along the floor of the cloaca and the mixture injected slowly.

Turpentine has long been used as an anthelmintic. A convenient method of administration is by means of a volumetric pipette with a blunt point which can be inserted directly into the crop. The dose per fowl is from 4cc to 6cc of turpentine in 15cc of mineral oil. The fowls should be fasted for about a day and receive a dose of Epsom salt twelve to eighteen hours before starting the treatment. A few hours after the administration of turpentine another laxative dose of salts is given. Epsom salt is best given in the mash using one pound of the salts for 100 birds. The feed should be well mixed and distributed, so that all members of the flock will receive their portion.

Tapeworms

Tapeworms are difficult to treat as their attachment to the intestinal wall makes them very resistant to the action of agents given to expel them. Kamala, male fern, areca nut, powdered pomegranate root bark, lye, turpentine and other agents have been employed as taeniafuges. Kamala is considered by many to be the best taeniafuge and individual treatment is recommended.[1] The therapeutic dose is 1gm. and fowls will tolerate 10gms. Birds weighing three pounds or over are sometimes given 2gms. of kam-

[1] Hall, Maurice C., & Schilling, Jacob E.: Kamala, a satisfactory anthelmintic for tapeworms in poultry. No. Amer. Vet., vii(1926), 3, pp. 51-58; 4, pp. 52-56.

ala. It is given in capsules or pills and fasting does not appear to be essential. Kamala causes purgation, therefore the use of other purgatives is not necessary, however, fasting and purgation may often aid in the removal of the worms. Bad results may occasionally occur in flocks affected with a chronic disease and for that reason it is advisable to determine the effects of kamala on a few of the birds, before treating the entire flock.

Capillaria

Parasites belonging to this genus are usually found directly in contact with the mucous membrane of the intestine and lying under a heavy covering of catarrhal exudate. Carbon tetrachlorid has been quite satisfactory for the removal of these parasites from birds.[2] The best results were obtained from a 1cc dose. A second dose is to be given about a week following the first treatment.

To prevent reinfestation with intestinal parasites it is necessary to thoroughly clean the quarters and the ground near the poultry house should be limed and plowed. The droppings should be removed frequently, placed in containers and covered with a screen, so that flies or other insects cannot have access to them. They should then be hauled as far away from the poultry house as possible.

Coccidia

Lactose appears to be effective in controlling coccidiosis in chicks. A mash containing 40 per cent of dry skim-milk or buttermilk has been recommended[3] and is fed when the first symptoms of coccidiosis appear or during the period of greatest danger, when chicks are from four to eight weeks old. Enough milk sugar must be consumed to maintain a constant acidity in the intestinal tract. The acidity produced in the ceca by the milk sugar seems to be injurious to some forms of the coccidia and the milk also stimulates rapid growth of the chicks, which increases their natural resistance.

[2] Rietz, J. H.: Observations on the species of intestinal parasites of poultry. Jour. A.V.M.A., lxx (1927), n.s. 23 (5), p. 659.

[3] Beach, J. R., & Davis, D. E.: The influence of feeding lactose or dry skim-milk on artificial infection of chicks with Eimeria avium. Hilgardia. i (1925), 8.

Crude catechu was recommended for coccidiosis by Fantham and is usually administered in the drinking water. About a gram of the powdered crude catechu is added to each gallon of water. If signs of constipation develop the flock should be given a dose of Epsom salt.

Quinin sulphate has been suggested for treating coccidiosis in fowls.[4] It may be given in the drinking water or in a mash moistened to make it crumbly and the drug thoroughly mixed with the feed.

Sanitation is very important in the control of coccidiosis and conditions must be provided for the young stock that will largely eliminate the ingestion of infective material. To be successful in controlling this disease, consideration must be given to frequent cleaning of the houses and to dryness as no sporulation of the oocyst takes place in very dry places.

Lice and Mites

Mites and lice which infest poultry houses can be destroyed by the use of insecticide sprays. High-grade anthracene oil, such as commercial carbolineum, have proved very efficient against the common red mite. Carbolineum is frequently thinned with kerosene to improve its spraying quality.

Commercial sodium fluorid is very satisfactory for the destruction of all species of poultry lice.[5] A single application will destroy all of the lice on a fowl. Sodium fluorid may be applied as a dust or as a dip. In the dry form its action is rather slow. Usually all lice will disappear in from four to five days and young lice apparently are killed as they emerge from the eggs. Lice are destroyed much more quickly by dipping. This should be done only when weather conditions are favorable. For the dipping solution one ounce of sodium fluorid is dissolved in a gallon of tepid water.

The feather mite may be destroyed by thoroughly dusting the fowls with flowers of sulphur. A more efficient method is to dip the birds in a solution containing two ounces of flowers of sulphur and one ounce of soap to each gallon of water. The solution must be stirred to keep the sulphur in suspension while dipping.

External Parasites

By F. D. PATTERSON, Jr., Auburn, Alabama
Veterinary Department, Alabama, Polytechnic Institute

Lice

THERE are several species of lice that are specific for poultry, all of which belong to the biting order. They are very active parasites and cause much irritation to fowl by crawling over their bodies and biting the birds. Lice spend their entire life upon their specific host, no phase of their life cycle being spent off the body of the fowl. The principal harm done adult birds is to annoy and irritate them, causing a decline in egg production. Not being blood suckers they do not sap the strength of their host so much. Baby chicks that come in contact with adult birds frequently suffer from lice, many infested chicks dying from their attacks. When they infest chicks they are found usually on the top and back of head, under the throat, and occasionally under the wings. It takes but a few to produce death of the chick. Mature birds are best treated by occasionally dusting them with sodium fluorid and keeping dust baths convenient. Baby chicks are best treated by applying a small quantity of grease as lard, olive oil, etc., to the heads and other affected parts of the baby chick, as often as necessary. This is very effective in controlling these parasites.

Fleas and Mites

Fleas and mites unlike lice do not breed on their host. They are blood suckers, living upon the nourishment derived from the fowl's blood. Much destruction is produced by these parasites.

Mites are nocturnal in their habits, hiding away in the day time in cracks, crevices or under straw and filth, coming forth at night to feed upon the blood of their host. Mites breed in their day time retreats. They are seen in the day time on setting hens, and weak birds. Setting hens annoyed by these pests often desert their nests, thus destroying the eggs entrusted to them to incubate.

Birds infested with fleas and mites become anemic, weakened and predisposed to attack from any disease. They often die from the direct effects of the parasites. In controlling these destructive poultry pests it is necessary that we keep up a continual fight against them in their breeding places. Houses should be kept clean and sprayed frequently throughout the year. It is not so hard to prevent and keep them under control but if they ever once get a firm hold they are very stubborn and make resistant foes. A good inexpensive spray can be made by using one part creolin to eight parts kerosene oil. This is to be frequently and thoroughly applied to all poultry buildings that are used by the birds. Whitewashing once or twice a year is a good practice and the use of a mixture composed of one part kerosene to four parts crude oil applied inside of poultry houses once a year is said to be effective.

Pyrethreum insect powder sometimes is useful in treating individual birds that are infested.

Stick tight fleas are not affected by ordinary measures once they imbed their heads beneath the fowl's skin. A combination of one part oil anise and eight parts alcohol is often effective in removing them from the fowl's head. Attacking their breeding places frequently and thoroughly are the best means of control. Lime and salt are somewhat effective when scattered on dirt floors as an aid in keeping down fleas.

Scaly leg mites are very small mites belonging to the sarcoptic mange family. These mites produce a very unsightly condition on the feet and legs of chickens—a condition that we are all very familiar with. This condition is best controlled by using kerosene oil on the affected parts, care being taken that none of the oil gets under the feathers or a severe blister may result.

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Favus—Ringworm

This ailment is caused by a fungus which produces a white elevated scaly condition of the unfeathered portions of the fowl's head. Easily spread to other members of the flock, and if neglected will spread to neck, destroying the feathers and producing a very unsightly bird. This ailment is best treated by using tincture of iodin, or an iodin ointment. Preparations containing salicylic acid are very effective.

Ticks

The fowl tick is a parasite found in the Southwest section of United States and in Mexico. I have never encountered them in this section. This species of tick is very harmful in infested localities. It is the intermediate host of the *Spirocheta gallinarum* which causes spirochetosis of fowls, a very fatal specific septicemia.

NOTICE: For lack of space it has been necessary to hold over till next issue a discussion of: Internal Parasites; Maintaining and Culling a Flock for Commercial Egg Production; Capons and Caponizing; The Treatment of Roup and Chicken Pox; Poultry Practice Problems, and Reviews and Abstracts of Recent Literature on Poultry Diseases.

CIVIL SERVICE EXAMINATION FOR JUNIOR VETERINARIAN

The United States Civil Service Commission announces an open competitive examination for junior veterinarian.

Applications must be on file with the Civil Service Commission at Washington, D. C., not later than April 28. The date for assembling of competitors will be stated on their admission cards, and will be about ten days after the close of receipt of applications.

The examination is to fill vacancies in the Bureau of Animal Industry, Department of Agriculture, for duty in the field.

The entrance salary is $1,860 a year. A probationary period of six months is required; advancement after that depends upon individual efficiency, increased usefulness, and the occurrence of vacancies in higher positions.

Applicants must have been graduated from a veterinary college of recognized standing, or must be senior students in such an institution and furnish proof of graduation during the existence of the eligible register resulting from this examination; provided, that the names of senior students who pass the examination will not be certified for appointment until they have furnished proof of actual graduation.

Competitors will be rated on veterinary anatomy and physiology, veterinary pathology and meat inspection, and theory and practice of veterinary medicine.

Full information may be obtained from the United States Civil Service Commission at Washington, D. C., or the secretary of the United States civil service board of examiners at the post office or custom house in any city.

Dr. Bernard Mann of Philadelphia, Pa., has been employed by the Master Fox Ranch, Inc., Philadelphia, as chief veterinarian. The experimental farms and research laboratories on their ranches located at Betzwood and Wyncote, Pa., in which all tests pertaining to the latest methods of breeding, feeding and care of fur-bearing small animals are conducted, will receive his personal supervision.

SAVE "ACCREDITED" FOR DISEASE-FREE FLOCKS

Whereas: A conference of state representatives called by the United States Dept. of Agriculture to meet in Chicago, Nov. 30th, 1927, for the purpose of adopting a uniform plan and terminology of poultry improvement and disease control work and,

Whereas: Thirty-five states were represented at said conference and adopted the plan submitted by the United States Dept. of Agriculture by a vote of twenty-three to twelve (23 to 12).

Therefore, be it resolved by the Southeastern States Veterinary Medical Association at its twelfth annual meeting in Jacksonville, Florida, Feb. 13 and 14, 1928, the action taken at the Chicago conference is approved and suggest that the plan adopted at the Chicago conference be placed in operation by the United States Department of Agriculture.

Be it further resolved that this association goes on record as being in favor of the use of the word accredited only in connection with disease control work.

W. B. Lincoln.
Benj. McInnes.
W. K. Lewis.

The Long Island Veterinary Medical Association held its regular monthly meeting at the Brookville Country Club, Glen Cove, on March 1st. Dr. Chas. S. Chase of Bay Shore gave a most excellent report on the Veterinary Conference held at Ithaca in January. The meat and milk situation as related to rural districts was discussed at some length by the members present. Problems encountered in every day practice were also brought up and discussed. The meeting was followed by a banquet.

J. M. Hendrickson, Sec'y.

Farmingdale, N. Y.